TRANSPORTATION AND THE ECONOMY

ASSESSING TRAFFIC-GENERATING ACTIVITY IN THE U.S. AND MINNESOTA

Wilbur Maki, Department of Agricultural and Applied Economics

University of Minnesota Center for Transportation Studies
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SUMMARY

The transportation policy perspective in this report starts with measures of the importance of transportation in the U.S. economy. First, it presents estimates of the total spending--private and public--for transportation and all its service modes. It briefly examines the underlying assumptions about personal consumption, government expenditures, business investment, foreign exports and imports, labor productivity, labor force participation and population growth for each of three scenarios of the U.S. economy in 2000 and 2005.

The 1988 and 1990 U.S. Bureau of Labor Statistics (BLS) and the 1988 U.S. Office of Business Economics Regional Series (OBERS) projection series serve as the baseline scenario. High and low economic activity scenarios are constructed that differ from the baseline scenario in their transportation requirements. The overall report series, of which this report is a part, presents the state and regional baseline series corresponding to the U.S. baseline series.

An initial focus of the study is the preparation of an economic framework for relating the transportation requirements of individual state and regional economies to the tasks of state and regional transportation systems policy and planning. The overall study provides estimates of individual state and regional implications of the several U.S. scenarios.

To demonstrate the applicability of future scenarios construction and use, this report presents a series of three U.S. and international economic futures. They translate into corresponding state and substate regional economic conditions facing transportation systems planners in Minnesota, the Metropolitan Council Region and Upper Midwest states. They focus on the prospects facing the exports-producing industries of each region and state.

The final demand sectors that purchase the outputs of a region's industries "drive" the producing sectors. However, some final demand is more important than another. For example, export demand sends new dollars into the economy that have a "multiplier" effect on virtually every industry in the local economy. Local sales, on the other hand, are dependent on the export sales. Increases in one category of local sales usually result in corresponding decreases in other local sales. Local sales are constrained by the level of export sales.

Sharp increases in commodity exports are projected for all scenarios. The value of all exports of goods and services is projected to increase from $630 billion in 1990 to nearly $880 billion in 2000 and over $1.2 trillion in 2005 in the "medium" or "moderate" scenarios (in constant 1982 dollars). Services, the largest single category in 1990, is projected to increase from $206 billion in 1990 to $233 billion in 2000 and $340 billion in 2005. Capital goods exports, the next largest category, is projected to increase from $200 billion in 1990 to $322 billion in 2000 and $479 billion in 2005.

Analysis of the principal determinants of the total transportation spending in the U.S. and in Minnesota's two substate regions--the Twin Cities Metropolitan Council Region and Greater Minnesota--shows the growing importance of the household sector in both directly traceable and indirectly related transportation spending. The direct spending includes purchases of transportation equipment, petroleum products, transportation services, motor vehicle insurance, motor vehicle repairs, and highway and related transportation facility construction and maintenance. Transportation-related indirect spending includes pollution abatement expenditures, compensation for loss of life and property not covered by the insurance premiums, and various government subsidies not included in the direct spending.

Transportation input requirements of the basic industries relate to the purchases of all forms of transportation as intermediate inputs in production, business investment, and consumption.. Purchases of transportation services for consumption include those of households and governments--federal, state and local.

Domestic, that is, local, within-state industry, household and government purchases of transportation total to $3.9 billion--in 1982 dollars. Foreign exports add another $105 million to this total. Commercial transportation is thus less than four percent of total product disbursements to intermediate and final markets in Minnesota that in 1990 totaled to $131 billion. Added to this product total are foreign exports of more than $10 billion. Federal, state and local government outlays for transportation are not included nor are the household expenditures for personal transportation. Also spending on transportation related manufactured products would add enormously to these totals--$3.2 billion for transportation equipment and $3.9 billion for petroleum products. The transportation industry cluster in Minnesota thus accounts for total spending, once adjustments are made for non-transportation uses of petroleum products and for public and personal transportation outlays, but exclusive of the uncounted social costs, that is equivalent to nearly 20 percent of the gross state product. This makes the transportation industry cluster a dominant sector of the state's economy that critically affects its viability and capacity to meet the new challenges of the global marketplace.

Households and manufacturing businesses are the leading markets for the transportation industry cluster in Minnesota. They account for more than three-fourth of the transportation equipment purchases, nearly 60 percent of petroleum product purchases, and more than one-half of the spending on commercial transportation. By far the larger of two is the personal spending of households for transportation-related services and equipment.

Manufacturing and the regulated industries group account for nearly $1.5 billion, or 62 percent, of the $2.3 billion of total spending on commercial transportation by the producing sector. One or the other of the two industry groups leads every mode of transportation spending.

Because of its facilitating functions in sustaining and expanding the access of the state's exports-producing industries to domestic and foreign markets, the transportation industry cluster continues to perform an important role in the state's economic future. It relates directly to the total value of these exports and in so doing provides a key measure of state's economic base.

This report concludes with a presentation of institutional considerations and productivity improvements affecting the future role and importance of transportation in the two Minnesota regions--the Twin Cities Metropolitan Council Region and Greater Minnesota. Its findings show that:

- Transportation is a key measure of the state's economic base.
- Wide differences exist among the alternative futures for transportation planning.
- Each future alternative has its unique trade-off for the Minnesota economy.
- Federal budget reductions provide savings for possible re-allocation to transportation.
- Large increases are projected in overall state and local spending, but these compete with transportation.
- Economic base is basic and so is transportation's measure of it.
- Market access and location make a difference in regional growth and development.
- Rural area service centers link with metropolitan core areas to form new regional industrial systems.
- Structural change critically affects transportation systems planning and policy
- Exclusionary land use practices increase transportation expenditures
- Productivity improvements in transportation create savings that reduce total public costs.

Thus, the macroeconomics assumption underlying each of the topical headings in the introductory discussions translate into corresponding levels of regional production, employment and income and purchases. These values are listed by individual industry and state in the overall study report. For Minnesota, they are listed for each of the two substate regions.

INTRODUCTION

This report focuses on transportation policy. It presents the findings on present and prospective U.S. traffic-generating economic activity and their implications for industry employment and earnings in Minnesota and the individual states of the five-state Upper Midwest Region and the twelve-state Northern Transportation Corridor. The regional data show present and prospective transportation expenditures for transportation services and facilities. The primary task was to provide the analytical frameworks and data for (1) assessing the productivity of resource use in the transportation sector and (2) facilitating transportation system adjustments to local and regional economic change.

Transportation Policy Perspectives

The transportation policy perspective in this report starts with measures of the importance of transportation spending in the U.S. economy. First, it presents estimates of the total spending--private and public--for transportation and all its service modes. It focuses on the distribution of total transportation-related spending by sector and mode. It briefly examines the underlying assumptions about personal consumption, government expenditures, business investment, foreign exports and imports, labor productivity, labor force participation and population growth for each of three scenarios of the U.S. economy in 2000 and 2005.

Transportation input requirements of the basic industries relate to the purchases of all forms of transportation services as intermediate inputs in production, business investment, and consumption.. Purchases of transportation services for consumption include those of households and governments--federal, state and local. This report, Part I of a two-part series, presents the findings on trends in the production and utilization of transportation services from a two-year study of Transportation and the Upper Midwest Economy.[1] Part II of this report series presents prospective changes in traffic-generating activity in Minnesota and the Upper Midwest.,

The Upper Midwest coincides with the Ninth Federal Reserve District, stretching 1300 miles westward from the locks at the international waterway joining Lake Superior and Lake Huron on the US-Canada border, across the Northern Great Plains and over the Continental Divide to the northwest corner of Montana and another international boundary. This is a peripheral region in its own right. A vibrant and vital metropolitan core area--the Twin Cities of Minneapolis and St. Paul--has far-reaching influence on much of this region.

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[1]This presentation draws from the final report of that portion of the overall study, entitled "Transportation and the Economy of the Upper Midwest" by Wilbur Maki, Zenaida Huelgas, Jun Zhao in the Department of Agricultural and Applied Economics. This study was funded, in parrt, by the Center for Transportation Studies at the University of Minnesota. Contributions of this report to the overall study objectives are included under "B. Projections of the Future Economic Structure of the Region" in the study Work Plan. Specific tasks are to:

1. Develop estimates of current and projected U. S. and global economic conditions affecting current and future economic activities in the study region and its various sub regions.
2. Develop estimates of current and projected economic status of the study region and its sub regions.
3. Analyze the consequences of selected scenarios of alternative economic futures, including a baseline projection, for the study region and its sub regions.
4. Develop estimates of current and projected future demand for transportation facilities and services in the study region and its sub regions for each of the alternative futures presented in Task 3.
5. Develop estimates of the current and future supply of transportation facilities and services in the study region and its sub regions for each alternative future presented in Task 3.
6. Analyze the policy implications for State and Federal government for the alternative scenarios developed in previous tasks. The implications should be developed for each state in the region.

In addition, this report addresses component C in the Work Plan, "Projection of Alternative Transportation Systems Under Alternative Assumptions". Under component C, the first major task is the use of the prescribed scenarios in projecting alternative futures for export trade between the Upper Midwest and the rest of the world. The two-year study from the Department of Agricultural and Applied Economcis completed a regional data base showing likely changes in the volume and variety of commodity and passenger traffic within the study region and between the region and the rest of world. This report also benefits from discussions and consultations with Doug Olson and Anwar Hussen, formerly Research Fellow and Research Assistant, respectively, Department of Agricultural and Applied Economics, University of Minnesota.

By extending the geographic boundaries of the study, we include all of 12 states from Michigan to Oregon and Washington. We call the 12-state territorial aggregation the Northern Transportation Corridor. This territorial aggregate is heavily dependent on transportation and related energy systems in their various forms. It includes four of the 29 air transportation nodes and, also, a large number of the most peripheral areas in the US. It thus includes parts of the large multi-area regions focused on three of the four metropolitan core areas. All of the Upper Midwest Region is in this territorial aggregation.

The Northern Transportation Corridor forms a territorial aggregation of 34 million people. The 12 states include the five western states of Oregon, Washington, Idaho, Wyoming and Montana with a combined population of slightly less than 10 million, the five Northern Plains states of Minnesota, Iowa, Nebraska, South Dakota and North Dakota with a combined population of slightly more than 10 million, and the two Great Lakes states of Michigan and Wisconsin with a combined population of slightly more than 14 million.

Alternative Regional Futures

This report provides projections of the U.S. economy in 2000 and 2010 based on the latest published reports of federal agencies. It converts these projections into corresponding transportation requirements of state and substate regional economies in the study region. It addresses the building of an economic framework for relating the transportation requirements of individual state and regional economies to the tasks of state and regional infrastructure planning.

Three scenarios of U.S. economic growth and change over the 20-year period from 1990 to 2010 are presented as an overall framework for assessing the role of public infrastructure, particularly transportation, in the state and regional economies of Minnesota, the Upper Midwest Region. Preparation and presentation of these scenarios addresses the purpose of the overall study by providing an appropriate and timely economic context for state and regional transportation infrastructure planning..

The three scenarios of U.S. economic growth and change stem from the widely used and accepted projections of the U.S. Bureau of Labor Statistics. They provide a "moderate", or "medium", baseline projection series and also, a "low" series and a "high" series for 2000 and 2005. The 2000 series are projected from a 1988 base year (Fullerton, 1989). This work was completed in 1989. The 2005 series are projected from a 1990 base year. This series was completed in 1991 (Saunders, 1991). The two sets of three scenarios differ, therefore, because of base year differences. They differ also because of underlying assumptions. These assumptions are central to the preparation and use of state and regional projections and scenarios.

The two alternate scenarios for 2000 and 2005 are based on different assumptions for four of the demographic indicators. The "low" scenario for 2000 assumes the same level of total population and the population 16 years and older as the "moderate" scenario. However, the civilian labor force is smaller because of lower labor force participation rates. Unemployment is higher because of the lower levels of industry production and related labor requirements. Lower production levels result in correspondingly lower levels of total employment.

The major assumptions affecting the BLS 1988 and 1990 aggregate projections of the US economy apply, also, to the state and regional economies addressed in this report. These assumptions are listed, first, as totals and averages of critical variables, like total population and its age distribution, federal government purchases by government function and producing sector. This presentation is followed by discussion of their percentage distributions among categories and annual rates of growth.

The gross national product increased by nearly $1.5 trillion (in constant 1982 dollars), or 2.9 percent per year, from 1975 to 1990. The "moderate" scenarios shows a $1.7 trillion or 2.3 percent per year, increase from 1990 to 2005. More than 72 percent of the earlier increase is attributed to an increase in total employment (Table 2.2). Less than 28 percent is attributed to an increase in real GNP per employee. In the 1990 to 2005 period the

contribution of total employment will decline while the contribution of real GNP per employee is projected to increase by more than 50 percent.

The high GNP per employee in the "high" scenario is associated with a higher proportion of final sales for private investment and exports and a lower proportion of final sales for personal consumption and government purchases than in the "low" and "moderate" scenarios. More than $1 trillion in GNP, moreover, separates the "low" from the "high" scenario in each of the two projection periods. However, federal and state tax rates remain at the same levels in all three scenarios.

The driving force for the economic growth in the three BLS scenarios is the productivity of the work force. Low growth correlates with low labor force productivity while high growth correlates with high labor force productivity. Thus, in spite of the larger population, a larger percentage of the total population is employed in the high growth scenario. It also has the smallest number unemployed. Labor force productivity accounts for this difference.

Productivity of resource use depends on the levels of private and public investment. These, in turn, depend upon the demand for products produced in U.S. industries, production costs, and the opportunities for profitable cost-reducing or market-expanding investment in new equipment, facilities and resource use practices. Interest rates play an important part in the level, type and timing of these investments. Interest rates, in turn, are affected by the US fiscal deficit and the "crowding out" effects of financing this deficit from a limited US and global savings pool.

The growth in GNP per employee associated with an increase in private investment makes possible export expansion and its rise as a proportion of total final sales. Improved productivity of U.S. export-producing industries and reduced demand for available savings to finance a federal fiscal deficit sustains export expansion in competitive global markets. These, in turn, involve corresponding reductions in the proportion of final sales for personal consumption and government, particularly military spending.

Measuring the Demand for Transportation

Measuring the demand for traffic-generating output addresses one of the weakest links in transportation policy and planning. We lack adequate information on the sources of demand for transportation--present and prospective. This lack is readily documented by examination of current procedures for determining future transportation demand and current and future transportation funding priorities. These procedures, if based on last year's population distributions and economic activity, are reminiscent of those used in water resources planning before the introduction of the U.S. Department of Commerce, Office of Business Economics Regional Series (OBERS) 50-year projections.

The 1988 OBERS projections for individual states, Metropolitan Statistical Areas, and U.S. Department of Commerce, Bureau of Economic Analysis (BEA) Economic Areas, for example, now serve as a common statistical framework for infrastructure planning in federal government agencies. Previously, however, some historical period provided the data for calculating benefits and costs. An important contribution of these projections is showing changes in the geographic distribution of this activity and its likely concentration in a limited number places in the region and state. Also important is the interregional trade, both domestic and international, generated by the export-producing industries in the areas of activity concentration.

The final demand sectors that purchase the outputs of a region's industries "drive" the producing sectors. However, some final demand is more important than another. For example, export demand sends new dollars into the economy that have a "multiplier" effect on virtually every industry in the local economy. Local sales, on the other hand, are dependent on the export sales. Increases in one category of local sales usually result in corresponding decreases in other local sales. Local sales are constrained by the level of export sales.

Sharp increases in commodity exports are projected for all scenarios. The value of all exports of goods and services is projected to increase from $630 billion in 1990 to nearly $880 billion in 2000 and over $1.2 trillion in 2005 in the "medium" or "moderate" scenarios (Table 1.1). Services, the largest single category in 1990, is

projected to increase from $206 billion in 1990 to $233 billion in 2000 and $340 billion in 2005. Capital goods exports, the next largest category, is projected to increase from $200 billion in 1990 to $322 billion in 2000 and $479 billion in 2005.

Table 1.1 Total exports of specified commodities (1982$), by year and scenario, US, 1990 and projected 2000 and 2005

			2000			2005		
Category	1975	1990	Low	Mod	High	Low	Mod	High
	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)
Exports of goods and services	259.8	630.3	776.3	879.9	1116.1	1110.5	1217	1351.4
Foods, feeds and beverages	20.1	37.8	46.2	49.9	62.4	47.7	51.5	58.6
Industrial supplies and materials	43.7	96	126.9	129.5	175.9	155.5	158.2	184.6
Capital goods	62.7	199.7	267.8	321.6	408.9	423.3	478.6	528.3
Automobiles and parts	23.4	30.7	43.4	49.4	57.8	39.9	46.1	50.9
Consumer and other goods	21.8	60.2	81.6	96.2	123.4	122.3	137.3	152.8
Services	88.1	205.9	210.4	233.3	287.6	321.8	345.3	376.2

In the "moderate" scenarios, the export GNP share increases from the 15.2 percent base to 16.8 percent in 2000 and 20.8 percent in 2005. Within the exports sector, capital goods and consumer goods together increase from 41 percent of total exports in 1990 to 47 percent in 2000 and 52 percent in 2005. Services, on the other hand, show a declining export share until 2000. By 2005, the three increasing categories would account for 80 percent of total exports. The remaining three categories would drop from 26 percent of total exports in 1990 to 20 percent in 2005..

Exports of foods, feed and beverages, along with industrial supplies and materials, are consistently below average in annual rates of growth. Exports of automobiles and parts are higher in the earlier than the later projections, indicating a change for the worse in the long-term market outlook for this commodity group. Capital goods, however, retain high growth rates in both projection series.

Four export categories decline in export share, although they increase in total value. The largest growth in exports and export market share is projected for the industry groups that share and above-average concentration in Minnesota. The importance of these industry groups in the Minnesota economy and the economies of the Upper Midwest Region and the Northern Transportation Corridor Region is discussed further under industry employment and output.

The U.S. National Income and Product Accounts (NIPA) show total personal consumption expenditures of nearly $2.3 trillion among 37 industry groups. Federal government purchases total to $329 billion, including $236 billion military and $90 billion non-military. State and local government expenditures total to $449 billion, of which $200 billion is for education. Thus, the total consumption spending exceeds $3 trillion. Total investment purchases exceed $614 billion while exports exceed $556 billion.

Import purchases have a totally different place in a local economy than export sales. Much depends on the destination of the imports. If the imports are production inputs purchased by local "value added" industries, the imports may contribute to exports and export expansion. If the imports are consumption inputs purchased by local households or government agencies, the imports share with locally-produced goods and services the total purchases of local residents. Thus, import replacement by local production may increase other imports, particularly those of local producing sectors.

Imports of goods and services from other countries parallel the growth of exports to other countries Table 1.2). They increased from $241 billion in 1975 to $668 billion in 1990 (in constant 1982 dollars). Their relative value increased from 8.9 percent of GNP to 16.1 percent of GNP. By 2005, total imports reach nearly $1.2 trillion in the "moderate" scenario or 20 percent of GNP. They exceed $1.3 trillion in the "high" scenario.

Table 1.2 Total imports of specified commodities (1982$), by year and scenario, US, 1990 and projected 2000 and 2005

Category	1975	1990	2000 Low	2000 Mod	2000 High	2005 Low	2005 Mod	2005 High
	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)
Imports of goods and services	240.8	667.8	787.5	829.0	1038.5	1143.9	1156.3	1343.1
Foods, feeds and beverages	14.6	25.2	20.1	23.1	27.7	26.8	27.7	31.8
Industrial supplies and materials	38.3	73.5	91.3	102.3	112.8	101.9	105.2	114.6
Petroleum	75.2	95.1	126.3	144.4	174.8	144.8	150.2	177.3
Capital goods	38.3	156.6	135.4	151.1	204.4	278.8	283.5	331
Automobiles and parts	23.1	64.2	49.1	78.2	100.0	80.1	88.8	108.2
Consumer and other goods	23.1	103.9	162.7	118.5	164.9	203.7	190.5	231.9
Services	28.2	149.3	202.7	211.4	253.9	307.8	310.4	348.3

The import mix in dollars changed sharply from industrial supplies and petroleum to capital goods. consumer and other goods, and services. In 1975, the two import groups accounted for 47.1 percent and 37.2 percent, respectively, of total GNP. By 1990, the two percentages are 25.2 and 61.5, respectively. In part, the shift in import is due to corresponding shifts in commodity prices relative to high-value product prices, but also to the changing structure of US industry and import regulations, The two trends continue in the projected series, with the first falling to 22 percent of GNP and second increasing to 68 percent of GNP.

Differentially changing annual growth rates for the individual import groups also show the changing product demands of the emerging global economy and its international trade implications. In the earlier set of commodity export projections prepared in 1988, imports grew at a 2.2 percent annual rate while industrial supplies and materials and petroleum imports grew annually by 3.4 percent and 4.3 percent, respectively.

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The 1990 projections show imports growing at 3.7 percent--more than 70 percent higher than the earlier projections. Capital goods, consumer and other goods, and services all grow at above-average rates--the opposite of the earlier projections, except for services.

Exports and imports of industry clusters and industry groups of individual states and substate regions within the US are many times greater than between individual states and their foreign destinations. Out-of-state commodity shipments and passenger traffic within the US economy thus generate the principal demands for transportation services. Their estimation, prediction, interpretation and implications for state transportation policy are the central focus of this segment of the Transportation and the Economy of the Upper Midwest Study.

CHANGING ENVIRONMENT FOR TRANSPORTATION SPENDING

Transportation as a passive player in U.S. economic growth nonetheless gains high marks in affecting the direction and location of economic change. Government is an important player in any local economy, affecting all transportation decisions. Federal, state and local outlays for transportation system improvements invariably involve changes in the economic base of local communities and commuting patterns.

The alternative levels of federal transportation outlays cited in this report are geared to the levels of federal budget re-allocation that would have accompanied the conversion of part of each year's military budget into deficit reductions and infrastructure expenditures in the early 1990s. Funding priorities now exist, however, that have become increasingly important funding recipients, particularly, reducing the federal fiscal deficit and rebuilding state and local infrastructure. In turn, US economic growth has its unique transportation services requirements increase at a more rapid rate as the value of domestic and foreign trade becomes an increasingly larger part of Gross Domestic Product

Losing the "Peace Dividend"

The financing of the public infrastructure expenditures in the early 1990s talk about the "peace dividend" originated from the reduced levels of military spending cited by the Congressional Budget Office (CBO) and used by Data Resources (DRI) in their estimates of the effects of reduced military spending in the 1990s. In these estimates total annual federal outlays start from the actual expenditures (in 1982$) of $230.1 billion in 1990. They included the values presented earlier for the "moderate" 2000 and 2005 scenarios in "baseline (BLS)" military spending option series and the corresponding values for the "deficit reducing" and "deficit increasing" scenarios. The baseline series represents an intermediate level of military spending that closely tracks the "1992 budget base force" military spending option presented earlier.[1]

Table 2.1 Total annual direct federal outlays in specified military spending option
U.S., 1991-2000 (1982 $)

Military Spending Option	1990	1992	1995	1997	2000	2005	2010
	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)
Baseline (BLS)	230.1	229.1	227.7	226.7	225.3	216	207.1
Deficit reducing	230.1	216.4	192.2	178.3	158.1	129.3	105.8
Deficit increasing	230.1	244.7	259.5	270.3	286	314.2	345.1

To illustrate: If one-half of the accumulated "peace dividend" were allotted to state and local governments for financing infrastructure development, a total allotment of $341.8 billion is available over the eight-year period from 1992 to 2000. If distributed proportional to total population, the Minnesota would total to $5.8 billion.

Reducing Federal Fiscal Deficits

Recall of the "peace dividend" and its subsequent loss serves as a reminder of the tough choices that face efforts to increase or redirect transportation infrastructure spending. Many claimants exist in close proximity to decision centers to affect the uses of any savings from a winding down of the "Cold War". Among the foremost competitors for additional infrastructure is the federal deficit.

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[1]The data sources for each of the gross product options (converted to 1982 dollars) are:
- CBO, January 1992, for the budget base force option to 1997 and 2002, extended to 2010.
- BLS, 1989, and 1991, for the 2000 and 2005 low, moderate and high projection series, extended to 2010.
- DRI for the deficit reducing and deficit increasing projections, extended to 2010.

Gross product options are the gross domestic product or gross national product values associated with each of the alternate futures presented earlier for the 20 year period from 1990 to 2010 (Table 2.2). They provide the overall fiscal framework for deficit reducing and infrastructure building efforts.

Table 2.2 Total annual gross domestic or national product in specified gross product option U.S., 1991-2000 (1982 $)

Gross Product Option	1990	1992	1995	1997	2000	2005	2010	1990-00	1990-10
	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(pct.)	(pct.)
1992 budget base force	4154.7	4168.8	4544.3	4781.6	5101.6	5683.2	6331.1	2.1	2.1
BLS, low	4221.0	4325.8	4488.0	4599.5	4771.9	5223.6	5718.1	1.2	1.5
BLS, moderate	4221.0	4404.6	4695.1	4899.3	5222.4	5842.6	6536.5	2.2	2.2
BLS, high	4221.0	4504.2	4965.1	5298.3	5840.4	6365.7	6938.2	3.3	2.5
Deficit reducing	4221.0	4434.0	4698.0	4933.0	5334.2	6073.2	7160.8	2.4	2.7
1990 baseline	4221.0	4451.7	4776.1	5007.8	5347.4	5965.4	6855.4	2.4	2.4

Extension of each gross product series to 2010 is based on the last five years of data for each of the reported series. Thus, the CBO and BLS series are based on their projected rates of change from 1997 to 2002 while the DRI series are based on their projected rates of change from 1995 to 2000. The BLS "low" and "high" series include the lowest and highest levels of GNP, with one important exception: 2010. The largest divergence among the six series is reached in 2010. Annual rates of growth in only two of the scenarios--"BLS, low" and "deficit reducing" are higher over the 20-year period than the first 10 years of the projection period.

High rates of U.S. gross product growth, notably in the "deficit reducing" scenario, are associated with underlying conditions for capital investment in productivity improving equipment, facilities and production methods and practices. The federal budget deficit is lower in the "deficit reducing" than the baseline projections. Thus the low interest rates maintained by reduced competition for available savings to finance a much reduced federal budget deficit provides additional incentives for long-term productivity improving investments.

Practical consequences of low interest rates and improved profitability of productivity improving investments include export expansion. Prior to the export expansion, a larger share of GNP is invested rather than consumed by households. Thus personal consumption expenditures decline as a share of total GNP.

Export expansion rests on a shift in current federal priorities from the present to the future. The short-term opportunity cost of budget reducing measures in the federal government are high. If the entire "peace dividend" were used to reduce the federal budget deficit, its contractionary consequences would reduce GNP growth in the first five years, as illustrated in Table 2.3. In the next five years, the earlier budget re-allocations would reap benefits in higher earnings for both labor and capital that would gradually reduce the GNP gap from what it would have been without the deficit reductions. If the rates of GNP growth of the 1995 to 2000 period were sustained for the next 10 years, the benefits would be even larger. They would be large enough to cover all of the year-to-year losses in GNP growth of the 1990s. Furthermore, the gains in productivity achieved with deficit reduction would continue to generate new benefits in future years.

Table 2.3 Difference in final sales between deficit reducing budget and 1990 budget, U.S., 1990-2010 (1982 $)

Final Sales Sector	1990	1992	1995	1997	2000	2005	2010
	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)
Total	0.0	-17.8	-77.7	-74.9	-13.2	107.9	305.4
Personal consumption expenditures	0.0	-8.5	-44.0	-42.8	-0.3	53.3	121.8
Gross private investment	0.0	-4.1	-2.1	24.9	57.4	146.4	277.0
Net exports of goods and services	0.0	8.3	24.4	26.8	48.4	84.8	138.3
Exports	0.0	8.0	5.2	17.7	39.1	90.8	167.2
Imports	0.0	-0.3	-19.2	-9.2	-9.4	6.0	29.0
Government purchases	0.0	-13.5	-56.0	-83.8	-118.7	-176.7	-231.6
National defense	0.0	-30.4	-71.2	-97.1	-134.3	-192.9	-248.4
Non defense	0.0	0.0	11.7	11.8	12.5	13.4	14.3
State and local	0.0	8.5	3.3	1.4	3.1	2.8	2.5

Increases in final product sales in the deficit reducing budget are directed towards private investment rather than personal consumption in the early 1990s. Analytical results show positive linkages between increases in private investment and export expansion. An increase of $106.5 billion in private investment is associated with a differential increase of $113.6 billion in exports and a differential decline of $84.9 billion in imports during the 1990-2000 period. In the next 10-year period, a differential increase in private investment of more than $1.4 trillion is associated with a differential increase of nearly $900 billion in exports and nearly $500 billion in personal consumption expenditures. Thus, the aggregate changes over the two 10-year period include the short-term income-reducing effects of reduced military spending and the first years of the long-term productivity-increasing effects of the shift from consumption to investment accompanying the reduction in military spending.

Rebuilding Public Infrastructure

Public infrastructure expenditures include federal, state and local ;government spending on transportation facilities and services and, also, education and training, water, sewer and solid waste disposal systems, and essential municipal facilities and services. State and local infrastructure expenditures generally include other public facilities besides transportation. Public education is viewed as an integral part of public economic infrastructure. In 1990, state and local government education expenditures--elementary and secondary, post secondary, and other education-related infrastructure--were slightly more than one-half of total infrastructure expenditures, These included highway, water and air transportation, transit and other transportation infrastructure as well as electric power and gas utilities, water supply systems, other urban facilities and natural resource-related infrastructure in the public sector.

Direct spending of $341.8 billion on state and local infrastructure over the eight year period from 1992 to 2000 amounts to 5.5 percent of total state and local government expenditures or 3.5 percent of total federal government expenditures in the 1990s. It is also equivalent to 34 percent of total grants in aid from federal to state and local governments projected in the "moderate" BLS scenario.

In 1990, education accounted for $187 billion, or 41 percent, of the $453 billion total state and local government expenditures in 1990 (Table 2.4). Transportation and community infrastructure together accounted for only $71 billion, or 15 percent, of the total. Education sector spending is disbursed more widely than transportation and other infrastructure because of (1) the larger initial wage and salary payments that are converted into personal consumption expenditures and (2) and the wide variety of direct procurement expenditures. The distinguishing characteristic of transportation and other infrastructure expenditures is the their concentration in the construction industry. The construction industry and related input suppliers are the principal industry beneficiaries of an expansion in state and local infrastructure spending.

Table 2.4 State and local infrastructure purchases of specified industry output, U.S., 1991 (1982 $)

Sector	Total	Edu-cation	Trans-portation	Comm Facilities	Other
	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)
Total	452.7	187.0	45.0	25.6	195.1
Agriculture, for., fish	1.6	0.7	0.0	0.4	0.5
Mining	0.3	0.1	0.1	0.0	0.1
Construction	85.3	16.9	35.5	12.0	20.9
Manufacturing	52.2	23.0	2.4	2.6	24.1
Durables	20.0	7.6	1.9	1.5	9.0
Non durable	32.2	15.4	0.5	1.2	15.1
Tran., comm., utilities	22.2	11.7	1.0	1.4	8.2
Trade	3.4	-2.6	0.3	0.6	5.1
Fin., ins., real estate	15.5	1.3	0.0	0.3	13.8
Private services	31.6	6.3	11.6	1.3	12.3
Government	240.7	129.6	7.8	11.6	91.7

The education infrastructure funding is largely in the elementary and secondary education category. Wage and salary payments account for the largest share of total outlays. These payments are recycled as personal income

disbursements--personal consumption expenditures, personal taxes, and personal savings. Thus, each of the three education expenditure categories disburses its expenditures among (1) institutional and student and (2) faculty and other staff purchases of goods and services.

Transportation infrastructure spending is dominated by highway construction and maintenance. Purchases of construction industry products and services account for more than 92 percent of total expenditures.

Other infrastructure includes electric, gas and sanitation utilities, water supply, urban facilities and natural resources-related functions. Construction expenditures again dominate the total infrastructure spending. Natural resource-related infrastructure expenditures are more widely disbursed than utility, water and urban facility expenditures because of the larger outlays for manufactured products and transportation, communication and public utility services.

Infrastructure development also would face its own "means" tests in measurable contributions to productivity improvements, firstly, in its own backyard, secondly, in the private sector. In such decision environment, short-term political choices would be compared with their long-term economic costs. Sadly, the likely alternative is even larger federal fiscal deficits that ultimately tax the credibility of existing institutions to govern prudently and wisely across the generations gap.

Redirecting Transportation Demand

The commercially-operated transportation industries, namely, railroad transportation, local and interurban passenger transportation, trucking and warehousing, water transportation, transportation by air, pipeline transportation, and transportation services, produced $250 billion of services in 1990, valued in 1982 dollars. Moving supplies to producers accounted for $163 billion of the total $280 billion transportation purchases from both private and common carriers, while moving people and products for final use and export accounted for the remainder. Household spending for personally-owned transportation added another $253 billion to the 1990 figures. Finally, state and local governments spent $46 billion on transportation infrastructure and related services in 1990. Thus. the total transportation bill for the US economy is at least $580 billion (in 1982 dollars)--an estimate that does not take into account much additional private transportation that escapes statistical tabulation. Even then, the US transportation bill is equivalent to 14 percent of the gross national product in 1990.

Because transportation is a necessary, but not a sufficient condition, of economic growth, it lacks the urgency of concern that is expressed for other expenditures that directly enhance the success of business enterprise in competitive global markets or the quality of life for the residents of a regional community. Much of commercial transportation operates at levels that return revenues less than costs in highly competitive local and regional markets. Non-commercial transportation provided by households and government, including transportation infrastructure, accounts for 65 percent of total transportation outlays in the U.S. economy. Thus, nearly two-thirds of the transportation spending is determined by values outside of competitive business enterprise.

In summary, three policy issues--reducing the federal deficit, rebuilding public infrastructure, and redirecting transportation demand critically affect the future of state and local transportation infrastructure spending. Recalling the loss of the peace dividend is a reminder of opportunities lost for lack of planning and resources to cope with changing global conditions. Reducing the federal deficit and rebuilding the public infrastructure are alternative uses of the peace dividend. Finally, a full accounting of the direct and indirect costs of urban sprawl reveals a massive misalloction of public resources in the subsidy of personal transportation.

PRODUCTION AND CONSUMPTION OF TRANSPORTATION IN THE UNITED STATES

The BLS Growth Model used in the preparation of the projection series to 2000 provides estimates of industry output, employment and value added changes associated with the increases in GNP in each of the three BLS scenarios (Kutchner, 1991). The transportation requirements of alternative economic futures are derived for the U.S. (and later for Minnesota and the Upper Midwest) from the University of Minnesota IMPLAN model of the U.S. economy. The gross product options cited earlier provide control totals for the IMPLAN estimates of transportation requirements of the U.S. economy in 2000 and 2010.

Transportation Linkages

Transportation linkages to local and regional economic activity are quantitatively represented by the transactions of businesses, households and government offices engaged in buying and selling transportation services from the transportation industry cluster. The industry delineation follows commonly accepted definitions of technology-intensive industries, further subdivided into principal product orientations. The 37 industry groups are aggregations of an initial listing of the 528 sectors in the University of Minnesota IMPLAN regional modeling system.

The *production* sector, for example, includes all agricultural production and services, mining, construction, and manufacturing.

The *transportation* sector includes the five principal commodity transportation modes--rail, motor freight, water, air and pipeline.

The *transportation equipment sector* includes the principal manufactures of transportation vehicles and parts that parallel four of the five transportation modes. Only the fabricated metals and other pipeline-related sectors are excluded.

The *communication* sector represents a complementary activity (with transportation) in facilitating trade and commerce among regions. At times, it may serve as a substitute for other forms of transportation.

The *energy* sector includes the production of energy sources from oil and gas fields and coal mines.

The *services* sector includes the remaining industries, namely retail and wholesale trade; banking, insurance and real estate; and a the entire gamut of private services. This is the largest sector of most local economies.

A multiplicity of transportation services are available from the producing sectors of local and regional economies. Commercial transportation services are purchased from private and common carriers. Non-commercial services are available in most U.S. households and government offices. In addition, state and local governments incur large annual expenditures building and maintaining an expanding transportation infrastructure. Also several large manufacturing industry groups--particularly, motor vehicles and equipment, air, rail and water transportation equipment, and petroleum refining--cater largely to the transportation sector of the global economy. In 1990, the total value of the aggregate of the transportation-related activities in the U.S. exceeded $1.1 trillion (in 1982 dollars). This was equivalent to 28 percent of the Gross National Product in 1990. The direct contribution to GNP was much less, of course, since the value added component of each dollar of sales varies greatly among the three manufacturing and six transportation industry groups.

Industry and sector purchases of transportation services associated with the projected economic growth in the "moderate" scenario are listed in the tabular summaries. Total input requirements are shown by mode and demand

category--final sales and intermediate sales. The input requirements of the producing, investing, consuming and exporting sectors are aggregated and summarized for each of the five categories of transportation services--rail, passenger, truck, water and air, and, also, an overall category of transportation services.[1]

A 67 percent larger increase in the purchases of all transportation services by the final demand sector is projected in the "high" scenario than in the "moderate" scenario. This increase compares with a 49 percent larger increase in communications and a 54 percent larger increase in public utilities. However, the projected increase in air transportation is slightly less, at 59 percent, than the projected increase in other transportation.

The "high" scenario, with its $1.8 trillion, or 41 percent, increase in total final sales, includes the largest allocations of industry output--27 percent--to foreign trade. Its allocations to personal consumption and private investment--45 percent and 25 percent, respectively--are at intermediate levels among the three scenarios.

The "low" scenario includes sharply reduced rates of growth in personal consumption expenditures and foreign exports compared with the corresponding values in the "moderate" scenario. Thus, the tradable commodities for personal consumption and the relating marketing margins show the smallest percentage increases. Of the $640 billion, or 14 percent, increase in total final sales in the "low" scenario, $310 billion, or 48 percent of the total, is allocated to personal consumption. The private investment allocation of $190 billion is 30 percent of the total while the $146 billion foreign trade allocation is 23 percent of the total. Private investment and foreign trade account for 68 percent of the final sales of manufacturing output in the "low" scenario..

Traffic-Generating Activity

The two goods-producing sectors (manufacturing and other)and two services-producing sectors (transportation, communications, and utilities, and other) are the intermediate markets for the transportation sector, while the next three sectors (personal consumption, private investment, and federal, state , and local governments) include the final domestic markets of the transportation sector. The economic activity linkages are represented by the value of the inter-industry and inter-sectoral transactions of the transportation sector.

The foreign trade of the U.S. economy also is represented by the inter-industry and inter-sectoral transactions of the individual sectors of the global economy. In 1990, the U.S. economy experienced a negative trade balance (in 1982 dollars). For some industry groups, however, foreign exports exceeded foreign imports. By 2000, each of the three scenarios show an overall shift to a positive trade balance. A projected resurgence in manufacturing exports accounts for the turnaround in net exports.

Table 3.1 presents the total value of domestic and foreign sales of all producing sectors in the U.S. economy in 1990 (in 1982 dollars) as a frame of reference for the estimates of transportation linkages. The producing and consuming sectors of the U.S. economy are listed by column. The producing sectors are also listed by row. Thus, the industry purchases are shown in the first four columns following the column of total domestic sales. Final domestic sales for consumption and investment are listed in the next three columns. Foreign exports and imports are listed last.

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[1]Estimates of transportation input requirements of the U.S. economy are available for the Transportation and Economy Study from two sources: the University of Minnesota 1985 and 1990 IMPLAN models for the U.S. and the BLS 1986 Growth Model for the U.S. The BLS Growth Model provides the interindustry transactions data, including individual industry transportation services requirements, for 222 producing sectors representing the U.S. economy. The IMPLAN models derive the effects of U.S. economic growth on total industry requirements, including transportation services. Unlike the BLS Growth Model, the IMPLAN models show all domestic transactions net of foreign imports. They show foreign exports and imports for both the final demand and the intermediate demand sectors. The IMPLAN results are further aggregated into 10 "one-digit" industry groups for reporting purposes.

Table 3.1 Total purchases of specified industry output, by domestic producing and consuming sectors, and foreign trade sector, U.S., 1990. (1982 $)

Industry	Total Domestic P:urchases	Manu-fact'g	Other Goods Prod'g	Trans., Comm., Pub Util	Other Services Prod'g	Personal Consump Expend	Private Invest ment	Federal State& Local	Foreign Exports	Foreign Imports	Net Exports
	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)
Total commodity disbursements	7289.6	1571.8	476.1	293.7	1118.8	2436.8	618.5	773.9	630.3	-667.8	-37.5
Agriculture, for., fisheries	181.6	102.3	50.0	0.1	12.2	15.7	0.1	1.2	23.7	-8.8	14.9
Mining	215.6	131.0	15.9	43.3	3.3	0.2	20.7	1.2	6.8	-105.4	-98.6
Construction	421.7	9.0	8.0	19.3	48.6	0.0	234.9	101.9	0.3	0.0	0.3
Manufacturing	2289.8	865.5	210.6	54.4	193.9	504.4	292.9	168.1	466.9	-562.2	-95.2
Durables	1231.8	450.5	146.8	14.9	51.7	150.7	290.4	126.9	368.9	-385.4	-16.5
Transp equip (exc motor)	109.6	16.9	0.6	4.1	0.7	11.3	18.2	57.7	41.6	-12.5	29.1
Motor vehicle & equip	157.4	50.6	0.7	0.7	10.8	60.1	28.4	6.2	24.1	-81.0	-56.9
Non durable	1060.8	416.5	65.1	39.5	142.2	353.7	2.5	41.3	98.1	-176.8	-78.7
Petroleum and coal prod	173.5	29.9	22.4	34.5	22.9	54.6	0.0	9.3	12.9	-47.0	-34.1
Tran., comm., public utilities	681.7	142.5	29.3	104.9	157.4	207.9	5.7	34	36.6	-9.4	27.1
Transportation	249.5	62.2	14.2	42.7	44.3	69.7	1.8	14.6	31.0	-4.1	26.9
Communication	118.0	9.7	3.1	5.8	35.5	55.0	3.9	5	4.8	0.0	4.8
Electric, gas, & sanitary serv	314.3	70.6	12.0	56.4	77.6	83.2	0.0	14.5	0.7	-5.3	-4.6
Trade	938.2	129.6	53.1	13.7	79.8	600.9	52.0	9.1	46.3	20.6	66.9
Fin., ins., real estate	908.1	47.4	39.1	18.5	296.1	477.0	12.2	17.8	28.4	-1.6	26.9
Private services	1219.8	136.4	69.2	37.5	304.4	609.5	0.0	62.9	21.0	-1.0	20.0
Government	433.4	8.2	0.8	2.1	23.2	21.3	0.0	377.8	0.3	0.0	0.3

In 1990 total domestic purchases of industry output was more than $7.3 trillion (in 1982 dollars). Commercial transportation services accounted for $250 billion of the domestic total purchases. This included $62 billion of purchases by manufacturers, nearly $43 billion by the transportation, communications, and public utilities group, slightly more than $44 billion by other services-producing industries, $70 billion by households, and nearly $15 billion by federal, state and local governments. In addition, foreign exports purchased nearly $31 billion of transportation services. For a more complete accounting of the size of the transportation-related industry cluster, add to all this approximately $200 billion of transportation equipment purchases (exclusive of purchases by manufacturers) and approximately $110 billion of petroleum product purchases (exclusive of purchases by manufacturers and the regulated industries group). Added to the totals for commercial transportation services are expenditures for personal transportation and government spending on transportation infrastructure. Household purchases of non-commercial transportation were more than $253 billion. They were more 10 percent of the total personal consumption expenditures, which totaled to more than $2.4 trillion. Government spending for transportation infrastructure is estimated at $187 billion in 1991.

Transportation Industry Clusters

Regulated Industries

The transportation sector is one of three sectors in the transportation, communications and public utilities industry group--the "regulated industries". The transportation sector has the strongest linkages with the manufacturing sector and the household sector. In reality, the household sector linkage is, in large part, attributed to the flow of manufactured products to retail markets for purchasing by households.

Table 3.2 provides a breakdown of the "regulated" industries as intermediate markets for the individual industry groups in the producing sector of the U.S. economy. It summarizes the dollar value of all inputs purchased by the regulated industries in 1990. These totaled to $675 billion, of which transportation accounted for $258 billion (in 1982 dollars). The total contribution of these industries to the gross national product is represented by the value of its primary input purchases--$382 billion for the regulated industries, $143 billion for transportation. Trucking and warehousing, and air transportation contributed, respectively, $87.3 billion and $69.2 billion in total industry output and $56.7 billion and $34.5 billion in value added. Intermediate input purchases totaled to $114.9 billion, with the largest share contributed by the petroleum product purchases of the air transportation industry. Finally, inter industry transactions within the transportation sector were more than $38 billion in 1990.

Table 3.2 Total purchases of specified industry output, by "regulated industry sector, U.S., 1990 (1982 $)

Industry	Transpor-tation only	Rail Trans	Local& Interurb	Truck& Wareh'g	Water Trans	Air Trans	Pipe-line	Trans Serv	Com-munic	Public Utilit	Total
	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)
Total industry output	257.9	31.4	13.0	87.3	32.3	69.2	8.5	16.1	140.4	276.9	675.2
Primary input purchases (va)	143.0	18.6	8.3	56.7	9.3	34.5	4.8	11.0	100.3	138.2	381.5
Total intermediate purchases	114.9	12.9	4.8	30.6	23.0	34.8	3.7	5.2	40.2	138.7	293.7
Agriculture, for., fisheries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mining	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	43.1	23.8
Construction	3.7	2.5	0.1	0.3	0.3	0.1	0.3	0.0	6.9	8.8	11.5
Manufacturing	29.0	4.2	1.7	5.4	3.6	13.3	0.5	0.3	5.8	19.6	39.9
Durables	7.5	1.7	0.5	0.6	1.6	2.8	0.2	0.1	4.5	2.9	11.1
Transport equip (exc motor)	4.0	1.0	0.0	0.0	0.6	2.5	0.0	0.0	0.0	0.0	4.1
Motor vehicle & equip	0.4	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.7
Non durable	21.5	2.5	1.2	4.8	1.9	10.6	0.2	0.2	1.3	16.7	39.4
Petroleum and coal prod	18.6	2.2	1.8	3.5	1.6	10.1	0.1	0.1	0.3	15.6	34.5
Tran., comm., public utilities	43.6	2.9	0.6	13.2	13.9	10.1	1.8	1.1	5.5	55.7	104.9
Intramodal trans transfers	3.1	2.2	0.0	0.5	0.1	0.3	0.0	0.1	0.0	2.2	5.3
Other transportation	35.2	0.4	0.3	11.8	13.2	8.8	0.3	0.6	0.9	1.4	37.5
Communications	2.3	0.1	0.1	0.7	0.3	0.7	0.0	0.3	2.7	0.7	5.8
Public utilities	3.0	0.2	0.2	0.3	0.4	0.3	1.5	0.2	1.9	51.5	56.4
Trade	9.1	0.6	0.8	3.2	0.5	3.4	0.2	0.4	1.5	3.2	13.7
Fin., ins., real estate	8.9	0.4	0.6	2.3	2.0	1.9	0.3	1.4	6.2	3.4	18.5
Private services	19.8	2.3	0.9	6.1	2.6	5.9	0.4	1.8	13.6	4.1	37.5
Government	0.6	0.1	0.1	0.2	0.1	0.0	0.0	0.1	0.7	0.8	2.1

Table 3.3 provides a breakdown of the regulated industries as input supply sources for the individual industry groups in the producing sector of the U.S. economy. It also provides a breakdown of the producing sectors as intermediate markets for the regulated industries. The leading intermediate markets for transportation services non-durable goods manufacturing (railroad; pipeline), private services (local and interurban passenger), the regulated industries (trucking and warehousing; water; transportation services), and durable goods manufacturing (air).

Table 3.3 Total sales of specified industry to intermediate demand sector in "moderate" scenario, U.S., 1990 (1982 $)

Industry	Agricul Forest & Fish.	Mining	Con-struction	Manu-fact'g	Durable Goods	NonDur Goods	Trans., Comm., Pub Util	Retail& Wh'sale Trade	Fin., Insur., RealEst.	Private Services	Gov't Enterpr
	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)
Transportation, only	3.2	1.0	9.9	62.2	26.8	35.4	42.7	18.1	3.7	15.4	7.1
Railroad transportation	0.8	0.2	2.0	14.6	6.4	8.2	5.3	0.8	0.1	1.9	1.8
Local & interurb pass. tran	0.1	0.1	0.2	3.2	1.7	1.5	0.9	1.4	0.4	2.7	0.2
Trucking and warehousing	1.9	0.4	6.9	26.5	12.6	13.9	16.6	12.3	1.3	5.1	2.7
Water transportation	0.2	0.1	0.5	5.0	1.1	3.9	13.4	0.3	0.1	0.3	0.3
Transportation by air	0.2	0.2	0.4	7.7	5.0	2.8	2.5	2.8	1.4	4.9	2.2
Pipelines, exc natural gas	0.1	0.0	0.0	5.3	0.1	5.2	0.3	0.1	0.0	0.1	0.0
Transportation services	0.0	0.0	0.0	0.1	0.0	0.0	3.7	0.5	0.4	0.4	0.0
Communication	0.6	0.2	2.4	9.7	5.3	4.4	5.8	12.1	7.5	15.3	0.6
Electric, gas, & san. serv	4.5	5.1	2.5	70.6	32.4	38.2	56.4	28.2	11.6	22.1	15.8
Tran., comm., utilities	8.3	6.2	14.8	142.5	64.5	78.1	104.9	58.3	22.8	52.8	23.5

Final sales of transportation are directly related to the economic activity and resident population in each region. The purchased transportation moves the locally-produced products in each region to their market destinations for consumption by households and governments, investment by businesses, and exports. Table 3.4 shows the distribution of the final sales valued at $117 billion in 1990 (in 1982 dollars). The leading final markets for transportation were foreign exports (railroad) and personal consumption expenditures (for all remaining transportation).

Final sales of industry output for the use of non-commercial transportation in the household sector accounted for 10 percent of total personal consumption expenditures in 1990. While a small portion of total household expenditures, the total spending for other infrastrucuture sevices purchased from private businesses and government enterprise, like communications, utilities, commercial transportation and private education, was over 80 percent of the amount spent on non-commercial transportation.

Table 3.4 Total final sales of specified transportation services in "moderate" scenario, by final demand sector, U.S., 1990. (1982 $)

Sector	Total Final Sales	Personal Consump Expend	Private Invest ment	National Defense	Federal Nondef	State& Local	Foreign Export	Foreign Imports	Net Exports
	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)
Transportation only, total	117.1	69.7	1.8	5.3	0.8	8.5	31.0	-4.1	26.9
Railroad transportation	12.5	5.6	0	0.5	0.1	0.4	6.1	-0.2	6.0
Local & interurban pass. transit	10.2	6.7	0	0.1	0	3.4	0	0	0
Trucking and warehousing	30.8	17.2	1.8	2.6	0.3	2.2	6.7	0	6.7
Water transportation	12.5	5.2	0	0.9	0	0.2	6.2	6.5	12.7
Transportation by air	45.3	31.4	0	1.2	0.4	2.1	10.3	-10.5	-0.2
Pipelines, except natural gas	1.5	1.0	0	0.1	0	0.2	0.2	0	0.2
Transportation services	4.3	2.7	0	0	0	0.1	1.5	0	1.5
Communication	68.7	55.0	3.9	1.2	1.0	2.8	4.8	0	4.8
Electric, gas,& sanitary services	98.4	83.2	0	2.4	1.2	10.9	0.7	-5.3	-4.6
Transportation, comm., utilities	284.2	207.9	5.7	8.8	3.0	22.2	36.6	-9.4	27.1

Individual industry requirements for transportation services over the 10-year period from 1990 to 2000 vary greatly. The air transportation industry accounts for the largest change--$12.1 billion--of the $31.3 total change in the transportation sector in the "moderate" scenario. However, the changes in communications and public utilities industry sales to the final demand sectors exceed those in the air transportation industry for the 1900-2000 period.

Projected Changes in Transportation-Related Activity

Table 3.5 shows a projected 10-year increase of $57 billion, or 23 percent, in transportation purchases compared to a projected increase of $1.5 trillion, or 21 percent, in total domestic commodity sales. The commercial transportation increases include $16.5 billion of purchases by manufacturers, $11.3 billion by the transportation, communications, and public utilities group, $4.8 billion by other services-producing industries, $52.3 billion by households, and $2.1 billion by federal, state and local governments. In addition, foreign exports purchased nearly $31 billion of transportation services. For a more complete accounting of the size of the transportation-related industry cluster, add to all this approximately $200 billion of transportation equipment purchases (exclusive of purchases by manufacturers) and approximately $110 billion of petroleum product purchases (exclusive of purchases by manufacturers and the regulated industries group). Still not included are the transportation-related purchases of households and state and local government--the upkeep of motor vehicles, streets and highways. State and local governments spent $45 billion (in 1982 dollars) in 1990 on roads, highways, terminals and other transportation infrastructure.

Table 3.5 Change in total purchases of specified industry output, by domestic producing and consuming sectors, and foreign trade sector, U.S., 1990-2000. (1982 $)

Industry	Total Domestic Sales	Manu-fact'g	Other Goods Prod'g	Trans., Comm., Pub Util	Other Services Prod'g	Personal Consump Expend	Private Invest ment	Federal State& Local	Foreign Exports	Foreign Imports	Net Exports
	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)
Total commodity purchases	1501.7	416.3	97.1	77.8	97.1	612.6	232.5	-31.8	249.6	-161.2	88.4
Agriculture, for., fisheries	32.2	27.1	1.1	0.0	1.1	3.9	-1	0	9.4	-2.1	7.3
Mining	55.0	34.7	0.0	11.5	0.0	0.1	8.7	0	2.7	-25.5	-22.8
Construction	93.1	2.4	0.9	5.1	0.9	0	85.1	-1.3	0.1	0	0.1
Manufacturing	509.2	229.2	19.9	14.4	19.9	126.8	112.7	-13.6	184.9	-135.7	49.2
Durables	261.3	119.3	1.9	4.0	1.9	37.9	109	-12.6	146.1	-93	53
Transport equip (exc motor)	8.8	4.5	0.0	1.1	0.0	2.8	7.4	-7	16.5	-3	13.5
Motor vehicle & equipment	38.5	13.4	0.1	0.2	0.1	15.1	9.8	-0.3	9.5	-19.6	-10
Non durable	248.3	110.3	18.0	10.4	18.0	88.9	3.7	-1	38.8	-42.7	-3.9
Petroleum and coal products	35.9	7.9	2.6	9.1	2.6	13.7	0.6	-0.6	5.1	-11.4	-6.3
Tran., comm., public utilities	153.1	37.7	15.4	27.8	15.4	52.3	2.4	2.1	14.5	-2.3	12.2
Transportation	57.4	16.5	4.8	11.3	4.8	17.5	1.9	0.6	12.3	-1.0	11.3
Communication	26.0	2.6	3.2	1.5	3.2	13.8	1.4	0.3	1.9	0.0	1.9
Electric, gas, & san serv	70.8	18.7	7.5	14.9	7.5	20.9	0.0	1.3	0.3	-1.3	-1.0
Trade	226.4	34.3	9.0	3.6	9.0	151.1	20	-0.6	18.3	5.0	23.3
Fin., ins., real estate	175.2	12.6	16.8	4.9	16.8	119.9	4.4	-0.1	11.3	-0.4	10.9
Private services	263.1	36.1	32.8	9.9	32.8	153.2	0.1	-1.8	8.3	-0.2	8.1
Government	-2.5	2.2	1.4	0.6	1.4	5.4	0	-13.4	0.1	0	0.1

Large increases in private investment and foreign exports--$232 billion and $250 billion, respectively--result in a smaller percentage allocation of the total gross product for personal consumption expenditures than in the 1975-

1990 period. For the 1990 to 2000 period, 54 percent of final sales is allocated to personal consumption expenditures, compared with 21 percent and 22 percent, respectively, to private investment and foreign exports.

The "moderate" projection series shows an increase in total final sales of more than $1.1 billion, 25 percent, from 1990 to 2000. The reported increases in final sales, except exports, again are reduced by the value of their import component. The BLS "low" scenario shows a much lower dependence on the transportation sector than the "moderate" scenario. The growth in all transportation services is cut by nearly one-half in the alternate scenario, although proportionately slightly less than public utilities, but more than communications.

The change in domestically-produced output of the regulated industries sector was valued at $70.2 billion, in 1982 dollars in 1990 (Table 3.6). Of this total, $31.3 billion was spent in moving goods and services to final markets. Foreign imports reduced the domestic portion of output value of the combined regulated industries sector by $2.3 billion, of which $1 billion is due to transportation imports.

Table 3.6 Change in total purchases of specified industry output, by "regulated industry sector, U.S., 1990-2000. (1982 $)

Sector	Transportation only	Rail Trans	Local& Interurb	Truck& Wareh'g	Water Trans	Air Trans	Pipeline	Trans Serv	Communic	Public Utilit	Total
	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)
Total industry output	68.3	8.3	3.5	23.1	8.5	18.3	2.3	4.3	37.2	73.3	178.8
Primary input purchases (va)	37.9	4.9	2.2	15.0	2.5	9.1	1.3	2.9	26.6	36.6	101.0
Total intermediate purchases	30.4	3.4	1.3	8.1	6.1	9.2	1.7	1.4	10.6	36.7	77.7
Agriculture, for., fisheries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mining	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	11.4	30.9
Construction	1.9	0.7	0.0	0.1	0.1	0.0	0.1	0.0	1.8	2.3	13.0
Manufacturing	7.6	1.1	0.4	1.4	0.9	3.5	0.1	0.1	1.5	5.2	28.8
Durables	1.9	0.4	0.1	0.1	0.4	0.7	0.1	0.0	1.2	0.8	7.7
Transp equip (exc motor)	1.1	0.3	0.0	0.0	0.2	0.7	0.0	0.0	0.0	0.0	1.1
Motor vehicle & equip	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.2
Non durable	5.7	0.6	0.3	1.3	0.5	2.8	0.1	0.1	0.4	4.4	10.5
Petroleum and coal prod	4.9	0.6	0.3	0.9	0.4	2.7	0.0	0.0	0.1	4.1	9.1
Tran., comm., public utilities	11.6	0.8	0.2	3.5	3.7	2.7	0.5	0.3	1.5	14.8	27.8
Intramodal trans transfers	0.8	0.6	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.6	1.4
Other transportation	9.4	0.1	0.1	3.1	3.5	2.3	0.1	0.2	0.2	0.3	9.9
Communications	0.6	0.0	0.0	0.2	0.1	0.2	0.0	0.1	0.7	0.2	1.5
Public utilities	0.8	0.1	0.0	0.1	0.1	0.1	0.4	0.0	0.5	13.6	14.9
Trade	2.4	0.2	0.2	0.8	0.1	0.9	0.1	0.1	0.4	0.9	3.6
Fin., ins., real estate	2.4	0.1	0.2	0.6	0.5	0.5	0.1	0.4	1.6	0.9	4.9
Private services	5.2	0.6	0.2	1.6	0.7	1.5	0.1	0.5	3.6	1.1	9.9
Government	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.6

Changes in input requirements of the "regulated industry" sector are driven by changes in transportation demand. These two industries account for $41.4 billion of the $68.3 billion growth in transportation sector output from 1990 to 2000. The largest absolute increase is in the demand for trucking and warehousing. The largest relative increase is in the demand for air transportation. Intra-modal and inter-modal demand is projected to increase by more than $10 billion.

Table 3.7 summarizes the projected changes in intermediate markets for transportation inputs. These changes, concentrated largely in the tradable commodities industries, show the emergence of the manufacturing industries as a pivotal sector in accounting for the differential effects of the projected changes in transportation requirements. The regulated also are part of the growth sector for the most rapidly-growing segment of transportation, namely, air transportation.

Table 3.7 Change in total sales of specified industry output to intemediate demand sector in "moderate" scenario, U.S., 1990 -2000 (1982 $)

Industry	Agricul Forest & Fisheries	Mining	Con-struction	Manu-fact'g	Durable Goods	NonDur Goods	Trans., Comm., Pub Util	Retail& Wh'sale Trade	Fin., Insur., RealEst.	Private Services	Gov't Enterpr
	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)
Transportation, total	0.9	0.3	2.6	16.5	7.1	9.4	11.3	4.8	1.7	4.1	1.9
Railroad transportation	0.2	0.1	0.5	3.9	1.7	2.2	1.4	0.2	0.0	0.5	0.5
Local & interur. pass. transit	0.0	0.0	0.1	0.8	0.5	0.4	0.2	0.4	0.1	0.7	0.0
Trucking and warehousing	0.5	0.1	1.8	7.0	3.3	3.7	4.4	3.2	0.4	1.4	0.7
Water transportation	0.1	0.0	0.1	1.3	0.3	1.0	3.6	0.1	0.0	0.1	0.1
Transportation by air	0.1	0.1	0.1	2.0	1.3	0.7	0.7	0.7	0.4	1.3	0.6
Pipelines, except natural gas	0.0	0.0	0.0	1.4	0.0	1.4	0.1	0.0	0.0	0.0	0.0
Transportation services	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.1	0.1	0.1	0.0
Communication	0.2	0.1	0.6	2.6	1.4	1.2	1.5	3.2	2.0	4.1	0.2
Electric, gas, & san. services	1.2	1.3	0.7	18.7	8.6	10.1	14.9	7.5	3.1	5.9	4.2
Tran., comm., utilities	2.2	1.7	3.9	37.7	17.1	20.7	27.8	15.4	6.0	14.0	6.2

Table 3.8 provides additional detail on final markets for U.S.transportation disbursements. The leading final markets are foreign exports (railroad; water; transportation services) and personal consumption expenditures (local and interurban; trucking and warehousing; transportation by air). The foreign exports utilize local transportation to move a product from its production site to its market destination.

Table 3.8 Change in total final sales of specified transportation services in "moderate" scenario, by final demand demand sector, U.S., 1990 -2000 (1982 $)

Sector	Total Final Sales	Personal Consump Expend	Private Invest ment	National Defense	Federal Nondef	State& Local	Foreign Export	Foreign Imports	Net Export
	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)	(bil.$)
Tranportation services, total	31.3	17.5	1.9	-0.7	0.1	1.2	12.3	-1.0	11.3
Railroad transportation	3.9	1.4	0.1	-0.1	0.0	0.1	2.4	-0.0	2.4
Local & interurban pass. transit	2.1	1.7	0.0	-0.0	0.0	0.5	0.0	0.0	0.0
Trucking and warehousing	7.8	4.3	0.9	-0.3	0.0	0.3	2.6	0.0	2.6
Water transportation	3.7	1.3	0.0	-0.1	0.0	0.0	2.5	1.6	4.0
Transportation by air	12.1	7.9	0.0	-0.2	0.0	0.3	4.1	-2.5	1.5
Pipelines, except natural gas	0.4	0.3	0.0	-0.0	0.0	0.0	0.1	0.0	0.1
Transportation services	1.3	0.7	0.0	0.0	0.0	0.0	0.6	0.0	0.6
Communication	17.4	13.8	1.4	-0.2	0.1	0.4	1.9	0.0	1.9
Electric, gas, & sanitary services	22.5	20.9	0.0	-0.3	0.1	1.5	0.3	-1.3	-1.0
Tran., comm., public utilities	71.2	52.3	2.4	-1.2	0.2	3.1	14.5	-2.3	12.2

Estimates and forecasts of U.S. final sales of transportation and transportation related products provide a frame of reference for measuring the final sales of transportation in the Upper Midwest and the Northern Transportation Corridor. (The six-volume series of reports cited earlier provide estimates and forecasts the two larger regions.) The regulated industry sector, which includes the transportation, communications and public utilities industry group, purchased nearly $294 billion of intermediate products. Total domestic sales of the transportation were nearly $250 billion. The producing sectors purchased $163 billion of this total.. Total consuming sector purchases--household and government--were $84 billion. Exports were $31 billion and imports $4.1 billion.

PRODUCTION AND CONSUMPTION OF TRANSPORTATION IN MINNESOTA

The assessment of transportation supply sources and markets in Minnesota is much like the U.S. assessment. Both local and imported transportation contribute to the total transportation supply. They are not separated in this presentation in keeping with the format for the U.S. assessment. Transportation markets are separated--local versus export, intermediate versus final. However, this report leaves the discussion of future transportation requirements of the Minnesota economy to second report in this series on transportation and the economy. Its focus in this section is the Twin Cities Metropolitan Council Region and Greater Minnesota in 1990 and their correspondence with the transportation-related activities in the U.S. economy cited earlier.

Transportation Linkage

Metropolitan Council Region

Table 4.1 shows the purchases of all economic sectors in the seven-county Metropolitan Region from local producing sectors. These purchases totaled to more than $74 billion (in 192 dollars)--slightly more than one percent of total U.S. domestic purchases. Commercial transportation accounts for $2.2 billion of the domestic total purchases. This includes $481 million of purchases by manufacturers, $433 million by the transportation, communications, and public utilities group, and $788 million by households--a total of $1.7 billion for the three sectors. Foreign exports add another $569 million to the total domestic purchases. Next to personal consumption of resident households, local manufacturing accounts for the largest purchases of commercial transportation.

Table 4.1 Total purchases of specified industry output, by domestic producing and consuming sectors, and foreign trade sector, Metropolitan Region, 1990. (1982 $)

Industry	Total Domestic Purchases	Manu-fact'g	Other Goods Prod'g	Trans., Comm., Pub Util	Other Services Prod'g	Personal Consump Expend	Private Invest ment	Federal State& Local	Foreign Exports	Foreign Imports	Net Exports
	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)
Total commodity disbursements	74561.9	14787.5	3335.3	2325.9	11235.5	28053.5	9452.4	5372.3	6401.6	5062.4	1339.2
Agriculture, for., fisheries	1346.9	837.2	167.9	1.0	216.7	106.3	4.0	14.0	40.3	30.1	10.2
Mining	278.7	93.1	88.4	90.2	1.0	2.3	0.8	2.9	1.6	1684.0	-1682.4
Construction	5366.0	116.3	16.6	213.5	722.4	0	3555.0	742.1	1.7	0.2	1.4
Manufacturing	26620.1	9586.1	1673.2	669.6	2153.7	6690.6	5295.3	551.6	4509.6	3206.6	1303.0
Durables	15044.6	5564.9	1191.3	162.0	846.6	2054.2	5042.4	183.3	3642.8	2234.6	1408.2
Transport equip (exc motor)	217.7	57.8	0.6	61.9	5.9	61.5	27.8	2.2	58.2	85.9	-27.7
Motor vehicle & equip	1644.2	277.9	6.0	7.2	195.4	1067.5	45.3	42.9	53.6	665.2	-611.6
durable	11575.5	4021.2	481.9	507.6	1307.0	4636.4	252.9	368.4	866.8	972.0	-105.2
Petroleum and coal prod	2211.7	222.2	237.9	454.4	216.8	934.9	38.4	107.2	82.9	24.3	58.6
Tran., comm., public utilities	6252.9	1332.0	284.4	760.1	1308.1	2202.7	68.9	296.8	603.6	89.6	513.9
Transportation	2234.1	481.4	188.9	433.4	210.6	778.5	35.4	95.8	569.3	62.8	506.5
Communication	1407.0	238.5	40.9	406.4	488.0	446.2	33.5	53.6	31.6	26.2	5.5
Electric, gas, & sanitary serv	2611.8	612.1	54.6	220.3	609.5	967.9	0	147.4	2.7	0.7	2.0
Trade	8020.9	958.8	376.9	61.1	298.4	5828.6	412.6	84.6	774.3	9.9	764.3
Fin., ins., real estate	9756.7	268.4	99.0	147.9	3144.0	5968.5	79.7	49.2	289.3	1.5	287.7
Private services	12796.2	1401.3	613.9	357.3	3067.0	7076.5	36.0	244.1	175.5	0.2	175.3
Government	4124.1	194.5	15.0	25.3	324.3	178.2	0	3386.9	5.8	40.2	-34.5

The total domestic purchases of $75 billion includes only the goods and services bought and sold in the seven-county Metropolitan Region. They do not include the income payments to resource owners that account for the value added by local economic activity. The sales values represent, therefore, the total market for goods and services in the Metropolitan Region, other than primary inputs. Foreign exports add more than 20 percent to this market in total transportation value.

Greater Minnesota

Table 4.2 shows the total value of goods and services bought and sold--other than labor, capital, and entrepreneurial services--in the 80 counties that form Greater Minnesota. In 1990 this totaled to more than $56 billion (in 1982 dollars). Domestic transportation accounts for $1.7 billion of this total. Foreign exports add

nearly $145 million or eight percent to the overall total--a much smaller percentage than the Metropolitan Region. Next to the personal expenditures of households, the other goods-producing industries group--agriculture, mining and construction--accounts for the largest purchases of transportation.

Table 4.2 Total purchases of specified industry output, by domestic producing and consuming sectors, and foreign trade sector, Greater Minnesota, 1990. (1982 $)

Industry	Total Domestic Purchase	Manu-fact'g	Other Goods Prod'g	Trans., Comm., Pub Util	Other Services Prod'g	Personal Consum Expend	Private Invest ment	Federal State& Local	Foreign Exports	Foreign Imports	Net Exports
	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)
Total commodity disbursements	56323.4	11065.1	6840.0	1380.3	5551.9	19914.0	5667.7	5905.1	3892.0	3579.1	313.0
Agriculture, for., fisheries	4234.8	2427.0	1520.8	0.8	137.7	78.4	41.5	28.6	800.8	50.2	750.6
Mining	422.0	107.3	169.8	113.8	13.7	1.9	12.3	3.2	108.6	626.7	-518.1
Construction	4161.5	74.1	109.2	175.5	438.0	0	2690.8	673.8	1.2	33.2	-32.1
Manufacturing	18928.6	5830.5	2457.0	270.7	1245.7	4764.3	2720.9	1639.6	1979.2	2435.5	-456.3
Durables	9583.9	2839.8	1144.0	64.7	432.2	1379.3	2574.8	1149.1	1218	1464.5	-246.5
Transport equip (exc motor)	316.3	117.6	1.6	6.5	1.9	35.0	144.8	8.8	53.9	121.3	-67.3
Motor vehicle & equip	945.2	41.2	17.4	5.1	125.2	702.8	6.2	47.3	94.6	547.1	-452.5
Non durable	9344.7	2990.7	1313.0	206.0	813.6	3385	146.1	490.4	761.2	971	-209.8
Petroleum and coal prod	1704.1	132.4	464.0	179.6	124.7	700.2	0.3	102.9	1.4	48.5	-47.0
Tran., comm., public utilities	5149.8	1006.1	899.3	475.5	764.1	1589.7	30.3	384.9	160	117.1	42.9
Transportation	1654.1	326.8	362.9	212.9	115.7	520.7	16.9	98.1	144.7	41.8	102.9
Communication	938.3	123.2	64.4	43.7	212.1	339.0	13.4	142.5	12.6	59.5	-46.9
Electric, gas, & sanitary serv	2557.5	556.0	472.1	218.8	436.2	730.0	0	144.3	2.6	15.8	-13.2
Trade	5579.4	596.8	475.0	29.9	173.3	4071.2	142.3	90.9	224.9	3.6	221.3
Fin., ins., real estate	6381.7	148.8	498.1	86.2	1233	4346.1	21.7	47.8	123.2	0.9	122.3
Private services	8544.1	769.2	682.1	209.0	1384.6	4932.7	8.0	558.6	48.7	0.2	48.5
Government	2922.4	105.5	28.7	19.0	161.8	129.7	0	2477.6	445.5	311.7	133.8

The commercial transportation purchase values omit personal and public transportation outlays. These are large for Greater Minnesota. They even may exceed the corresponding values for the Metropolitan Region, given the concentration of many personal and shopping services in the Metropolitan Region together with the much larger geographical coverage and history of public roads and bridges construction and financing in Greater Minnesota.

Transportation Industry Clusters

Metropolitan Council Region

Table 4.3 shows the distribution of mode-specific transportation purchases among the large industry groups. They represent the intermediate markets for transportation in the Twin Cities Metropolitan Council Region. Among the top markets are the regulated industries group (trucking and warehousing; pipeline), non-durable goods manufacturing (railroad; trucking and warehousing; water), durable goods manufacturing (trucking and warehousing; air), and private services (air). The leading intermediate markets thus differ for each transportation mode, although the regulated industries group is the one of the largest markets for each of the seven transportation modes or groups.

Table 4.3 Total sales of specified industry to intermediate demand sector in "moderate" scenario, Metropolitan Region, 1990 (1982 $)

Industry	Agricul Forest & Fish	Mining	Con-struct	Manu-fact'g	Durable Goods	NonDur Goods	Trans., Comm., PubUtil	Retail& Wh'sale Trade	Fin., Insur., RealEst	Private Service	Gov't Enterpr
	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)
Transportation, only	22.9	0.9	165.1	481.4	172.4	309.0	433.4	46.4	43.4	100.3	20.5
Railroad transportation	1.3	0	8.1	84.6	18.0	66.7	28.5	0.7	0.2	3.8	1.3
Local & interurb pass. tran	0.1	0	0.6	2.7	1.3	1.4	2.2	2.0	2.7	2.7	0.3
Trucking and warehousing	17.4	0.6	139.8	321.2	123.1	198.1	197.8	33.6	22.9	41.7	10.6
Water transportation	0.1	0	0.7	5.2	0.9	4.3	1.9	0.1	0	0.6	0.2
Transportation by air	0.8	0.1	3.0	40.4	22.6	17.8	19.0	4.0	8.9	28.4	3.3
Pipelines, exc natural gas	3.3	0.2	12.9	26.9	6.3	20.6	46.8	4.9	2.0	18.6	4.8
Transportation services	0	0	0	0.3	0.2	0.2	137.2	1.0	6.6	4.5	0.2
Communication	2.1	0.3	38.4	238.5	144.7	93.8	106.4	76.8	108.8	296.4	5.9
Electric, gas, & san. serv	14.3	5.6	34.7	612.1	294.0	318.1	220.3	135.0	18.9	263.7	192.0
Tran., comm., utilities	39.3	6.8	238.2	1331.9	611.1	720.8	760.1	258.2	171.1	660.4	218.4

Another important difference among the intermediate markets is the substitutability of transportation for communication services, particularly in the wholesale trade, finance, insurance, and real estate, and private services sectors. These differences exist in manufacturing, given the apparently larger outlays for communications services relative to transportation in the durable goods-producing manufacturing group--the sector that also has the much larger foreign exports.

Greater Minnesota

Table 4.4 shows the importance of agriculture and manufacturing in the economic life of Greater Minnesota. These two industry groups, together with the regulated industries, account for $746 million, or 73 percent, of the $1 billion intermediate market for transportation in Greater Minnesota. In addition, agriculture and manufacturing account for most of the nearly $145 million in foreign exports of transportation.

Table 4.4 Total sales of specified industry to intermediate demand sector in "moderate" scenario, Greater Minnesota, 1990 (1982 $)

Industry	Agricul Forest & Fish.	Mining	Con-struct	Manu-fact'g	Durable Goods	NonDur Goods	Trans., Comm., Pub Util	Retail& Wh'sale Trade	Fin., Insur., RealEst	Private Service	Gov't Enterpr
	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)
Transportation, only	206.5	25.1	131.3	326.8	104.9	222.0	212.9	33.1	11.2	49.7	21.8
Railroad transportation	15.3	2.0	6.5	47.3	12.5	34.8	29.3	0.5	0.1	2.4	3.5
Local & interurb pass. tran	0.1	0.1	0.5	1.3	0.6	0.7	1.5	1.3	0.7	1.2	0.1
Trucking and warehousing	162.8	17.6	111.2	241.4	76.5	164.8	138.4	26.1	6.0	22.9	7.0
Water transportation	0.9	0.2	0.6	3.4	0.7	2.8	1.9	0.1	0	0.3	0.2
Transportation by air	1.9	1.5	2.4	20.5	10.8	9.7	3.2	2.1	1.6	11.9	1.9
Pipelines, exc natural gas	25.5	3.8	10.2	12.7	3.6	9.1	14.9	2.7	0.5	9.5	9.1
Transportation services	0	0	0	0.2	0.1	0.1	23.8	0.3	2.3	1.5	0
Communication	26.9	6.9	30.6	123.2	71.8	51.4	43.7	48.6	26.4	134.1	3.0
Electric, gas, & san. serv	185.9	258.4	27.7	556	168.9	387.2	218.8	81.8	4.9	178.7	170.9
Tran., comm., utilities	419.2	290.4	189.7	1006.1	345.5	660.6	475.5	163.4	42.5	362.6	195.6

Agriculture and manufacturing, together with the regulated industries, are the leading intermediate markets for transportation in Greater Minnesota. Non-durable goods manufacturing is the leading market for rail transportation, followed by the regulated industries group, while agriculture and the agriculture-related manufacturing represent the largest market trucking and warehousing. Agriculture, because of its very large purchases of petroleum products, is thus indirectly the largest market for pipeline transportation. All marketing margins, like transportation, accrue to the end user of the manufactured product.

ACCOUNTING FOR REGIONAL GROWTH AND CHANGE IN TRAFFIC-GENERATING ACTIVITY

We assess, in this section, the determinants of regional economic growth and change that, in turn, affect the demand for transportation. We combine the findings of two other studies: the first focuses on business volatility and economic growth (Reynolds and Maki, 1990); the second on transportation and the economy of the Upper Midwest Region (see: Maki, Huelgas and Chao, 1992). We also make use of insights gained from a third study that documents the changing patterns of job and income growth in core and peripheral labor market areas and their related change sources (Reynolds and Maki, 1991; Maki and Reynolds, 1992, 1993). The findings we assess in this section cover the two long periods of economic recovery--1970 to 1980 and 1982 to 1986--separated by two recessions occurring in the 1980-82 period. Jobs, labor income, population and labor force are the principal economic and demographic indicators used and presented in this study.[1] The principal findings are reported under two topical headings that follow--labor market areas and industry differentiation.

Labor Market Areas

Labor market areas (LMAs), based on commuting-to-work data from the 1980 US Census of Population are the principal units of analysis (Tolbert and Killian, 1987). These are the commuting areas of individual county residents as reported in the 1980 U.S. Census of Population and Housing. Commuting areas overlap state boundaries where the largest city in the area is located near a state boundary. Thus, the 3,124 US counties are aggregated into the 382 LMAs that serve as the relevant geographical units for assessing area economic performance.

The 77 LMAs in the Northern Transportation Corridor split into two parts. Forty LMAs are in Mid-continent West and 37 LMAs are in Mid-continent East. The West accounted for about one-third of the total earnings in 1970. By 1986 the West accounted for 39 percent of this total. Thus, the Northern Transportation Corridor tilts sharply and symbolically to the West over the 1970-86 period. The automobile-based Michigan economy, for example, was out-performed by the air transportation-based economy of Washington. Moreover, the development of the energy resources of the West during this period added to its already rapid growth.

The local labor market areas of the Upper Midwest delineated in Figure 5.1 extend beyond the six state boundaries into the 12-state Northern Transportation Corridor. The individual labor market areas define the commuting areas of individual county residents. Area boundaries mark the counties with approximately the same numbers of residents

[1] Two modes of statistical analysis are used: regression and shift-share. The regression analysis relates a series of independent, explanatory variables to change in employment. In the shift-share analysis, change in industry-specific labor earnings is attributed to three change sources--national growth, industry mix and regional share over the 1970 to 1986 period. The national growth effect in the shift-share analysis is represented by change in total labor earnings over all industries in the U.S.. The industry mix is measured by differential change in industry-specific labor earnings in the U.S. economy. National growth and industry mix account for the external determinants of regional change. The regional share effect is measured by the differential change in industry-specific labor earnings in a given region. It accounts for an industry's competitive position in the given region relative to the same industry in the Nation. Regression analysis was used to estimate the statistical association between a series of economic and demographic indicators and period-to-period change in total wage and salary employment. Regression models of the form cited earlier in this report were fitted to existing county-level data aggregated for the 382 multi-county LMAs. All variables were normalized for varying levels of total employment by converting total change into percentage change (that is, dividing the total change over each two-year period with its first-year value). Growth in total labor earnings of industry employment is one of two measures of economic well-being in individual LMAs used in this study. Labor earnings accounts for 70 to 80 percent of personal income. The other two components--property income and transfer payments--split the remainder, with roughly equal amounts contributed by each. The other measure of local economic well-being is total industry employment. Each measure of regional growth analysis varies in relative values from one period to the next. For some areas, the volatility in rates of regional growth is due to the cyclical sensitivity of the local economy. For others, the period-to-period changes in jobs and earnings are related to long-term changes in industry product cycles. Changes in industry mix reveal both short-term and long-term changes in the importance of individual industries in the U.S. economy. Changes in regional share reveal changes in the competitive position, or economic performance and importance, of a given industry relative to the corresponding industry in the U.S.

commuting to adjacent local labor markets, according to the 1980 U.S. Census of Population reports for the individual states.

Figure 5.2 differentiates among labor market areas (LMAs) of the U.S. by growth in total jobs over the period from 1978 to 1988. The largest concentration of low rates of job growth is in the Northern Transportation Corridor. This includes the six Upper Midwest states. Within the Upper Midwest boundaries, however, are two high growth LMAs--Minneapolis-St. Paul and St. Cloud. These two LMAs make up the metropolitan core area for the Upper Midwest states.

Figure 5.3 differentiates among LMAs in the U.S. by new business formation. Findings of a related study (Reynolds and Maki, 1991) show a high correlation between new business formation and economic growth, especially in rural areas. This study shows, also, a high correlation between business volatility and economic growth. The working hypothesis for the related study focused on business volatility as an essential condition of a dynamic regional economy.[2] The several types of labor market areas fall into three distinct groups--the metropolitan core area, a transitional area and the periphery.

Metropolitan core area. Proximity to metropolitan areas further differentiates local labor markets. The metropolitan areas, like the combined 12-county Minneapolis-St. Paul labor market area (LMA) and the contiguous four-county St. Cloud LMA represent the core LMA for the Upper Midwest.

The *metropolitan core area* includes the downtown district of the central city, the neighborhoods of the extended central city, and "ex-suburbia" beyond the second-ring suburbs. Its innovative products and production processes, together with a diversity of economic activity and resources, account for its sustained growth and development (Noyelle and Stanback, 1984). The metropolitan labor market area is Jane Jacobs' city region. Its influence extends, however, beyond the local labor market to remote rural areas in its periphery.

Our study findings show that core labor market areas have a similarity of economic functions and roles in the emerging global information economy. They are the world class transportation, telecommunications and distribution centers. They have a rich diversity of industries--the export-producing and import-replacing sectors of manufacturing, transportation, finance, insurance, banking, business and other producer services, and consumer services like entertainment, recreation and health care.

Most important are the strategic management functions in the core area downtown district. These functions require one-on-one relationships between information providers and information users. They include the highly differentiated information services for achieving and maintaining the competitive edge of local businesses in regional and world markets (Porter, 1990).

Central cities that form the core areas of the city region have the diversity of industry, producer services, and business entrepreneurship to innovate and improvise in the development of new products and processes that replace existing imports and expand exports. They are an integral link in the global transportation and communication network (Irwin and Kasarda, 1991). The gross domestic product ultimately depends on the success of the central cities in expanding their trade with other cities and labor market areas of the city region.

The central city faces continuing internal challenges as it becomes the change-agent of the new global economy. Its downtown district transforms into the "nerve center" of the city region (Daly, 1991; Moss and Brion, 1991). Air transportation and telecommunications systems, along with a full range of strategic management and other producer

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[2]Changes in the number of establishments and related jobs due to their establishment births and deaths, expansions and contractions define business volatility. This includes four variables--autonomous births and deaths and branch births and deaths--that represent firm volatility. Also, eight variables--the factorial combination of autonomous and branch, births and deaths, and expansions and contractions--represent job volatility. Business volatility is the composite of job volatility and firm volatility.

services, must connect the downtown businesses with domestic and international clients and customers on virtually a real time basis (Beyers, 1991).

Yet, one-on-one relationships among information providers and users are even more important in the downtown district than ever before because of the uniqueness of information--its principal product--and its inherently differentiated content (Hutton and Ley, 1987; Ley and Hutton, 1987). The downtown district transforms the high cost of access to these one-on-one relationships into a locally connected global information center through its strategic management functions and supporting infrastructure and services (Daly, 1991).

For the core areas, imported goods and services are essential inputs in production and consumption. The more diverse the area, the more likely that intermediate rather than final markets account for the larger share of total imports. The export-producing activities make these purchases possible. As exports expand, imports also increase.

At some point opportunities for import replacement attract new locally produced products for local consumption. These opportunities occur because of the innovations and improvisations, mostly from small businesses, that result in import-replacing products entering local markets.

Rural periphery. The *periphery* of the multi-area economic region is characterized by LMAs furthest removed from the core LMA functions. The peripheral LMAs lack convenient and low-cost access to decision information for business enterprise. They are vulnerable to the general business cycle and the product cycles of the standardized, highly tradable commodities that typically are produced in the periphery. The low-cost producer dominates competition in commodity markets. This translates for the export-producing businesses in the periphery into extreme dependence on low wages or, alternatively, high productivity in resource use. High labor and total factor productivity, in turn, depend on high levels of investment per worker. Most businesses in the periphery suffer from low investment per worker.

The *periphery* of the city-region exports standardized products. These products compete on a price basis. Low unit cost of production translates into a competitive market price, which, in turn, depend on high labor productivity or low wages. The periphery lacks cities that trade with other cities and gradually acquire skills and resources to replace imports with their own production.

The periphery includes labor market areas in varying stages of development and decline. The LMAs are sources of supply of primary products--farm, forest and mine. These are the supply areas for the secondary production centers. A few of the LMAs are transplants--the resident locations of branch plants from the core areas. Still others are rapidly declining economies experiencing the effects of labor-reducing technological advances in local production. Ever-increasing production levels require fewer and fewer workers. Finally, the LMAs workers have abandoned are the relics of an earlier period of economic activity.

Between the core Labor Market Area (LMA) and its periphery are the *transitional areas*.[3] The transitional LMAs closest to the core area experience rapid population and job growth. They have an expanding manufacturing base as a result of low site costs--rent, labor, and environmental, coupled with excellent access to metropolitan area markets (Scott, 1986). For many counties in the transitional areas, the percentage rates of growth exceed those in the metropolitan core area.

[3]Transitional rural areas adjoin the metropolitan core area and extend to the outer commuting limits of the core area work places and even slightly beyond (Reynolds and Maki, 1991). Within the 60-mile or so radius of the core area, farm subdivision is a common practice because of the high demand for part-time, hobby and garden-type residential farms. Off-farm employment of one or more family members supplements farming as an income source. The employment opportunities occur in manufacturing plants locating or expanding in the transitional rural areas and in trade and service establishments of growing rural service centers.

We refer now to innovative and versatile production--a phrase borrowed directly from Jane Jacobs. It is the unique contribution of the metropolitan core area to local renewal and revitalization. It relates also to the economic base of the city-region and its vulnerability to changes in global and regional markets and government policies.[4]

The base economies of the high volatility LMAs are marked by high levels of industry specialization in farming, mining or manufacturing. In these areas, the high income volatility is associated with a high degree of vulnerability to the vicissitudes of cyclically-sensitive export markets. Moreover, the extreme specialization of industry in the base economies of the high income volatility LMAs persisted through the 1970s and many of the 1980s. Where high income volatility was accompanied by slow income growth, the local base economies also faced shrinking export markets.

High income growth areas differ from high income volatility areas and low income growth areas in the diversity of their base economy. Even specialized base economies support high income growth when the export-producing sectors remain competitive in their export markets and maintain their market shares. Generally, however, the specialized fast-growing economies had lost their earlier momentum by the mid 1980s and faced, instead, much reduced income growth.

Industry Specialization

Excess labor earnings, when used as a measure of the geographic concentration and specialization of industry, also defines the area economic base. It refers to the positive difference between a given area and the U.S. in the percentage distribution of total labor earnings in a given industry. This positive difference is multiplied by the area's total industry earnings in deriving the area's excess labor earnings for the specified industry. Thus, the excess earnings variable also describes the area-to-area linkages of an industry.

The *export-producing* industries account for much of the economic base of the local labor market area. Income payments from prior expenditures of local residents or transfer payments from public and private sources outside the area account for the remainder of the local economic base. Finally, each of the state governments in the Upper Midwest has overall jurisdiction for transportation policy and planning within its territorial boundaries.

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[4] These volatility measures (not to be confused with business volatility) are simply summary statistics for describing the economic history of each of the 100 LMAs. Historically, the two parts of the Northwest Transportation Corridor experienced much income volatility due to the natural resource dependency of the interior states and the cyclically sensitive durable goods manufacturing. The principal reasons for the contrasting growth patterns rest with the base economies of the two regions. Not only are the local base economies of Mid-continent East dominated by below-average growth industries, but they also are marked by a continuing decline in the competitive position of their principal exports. The base economies of the comparison region are distinguished by an overall above-average industry-mix effect and an overall above-average regional-share effect. Historically, also, the individual states in this territorial aggregate trade much with Canada, particularly Ontario in the East and British Columbia in the West. Recent enactment of the US-Canada Free Trade Agreement further strengthens the already strong economic linkages between these long-time trading partners.

The remaining 23 comparison LMAs include both rapidly growing and generally declining base economies that vary in income volatility and overall growth from the lowest to among the highest. They provide comparison with a wide range of regional basic industries and growth histories.

A distinguishing characteristic of declining and growing areas is the rapidity and direction of change in jobs and labor earnings. Once the volatility in jobs and income is removed, the residual "regional-share effect" becomes a measure of regional growth and decline. The results are the shift-share value for 100 selected US labor market areas cited earlier.

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The export-producing sector of local industries brings "new" dollars into the area. This sector includes, in varying degree, parts of most industry groups, namely, agriculture, mining, construction, manufacturing, transportation, communications and public utilities, retail and wholesale trade, finance, insurance and real and estate, hotels and lodging, personal services (for visitors), business services, automobile services, entertainment and recreation, medical and health care, legal, educational and social services, museums and zoos, nonprofit organizations, management, consulting and other professional services, and government.

Export-producing industries link the individual LMAs to each other and to regional and global markets. They generate the commodity tonnage transported from one LMA to another. They also serve the passenger traffic between LMAs and global origins and destinations.

Criteria for assessing the vulnerability of an area's economic base--risk, costs, productivity, and flexibility--vary by location of an area in the city-region settlement system where the core area is the principal transportation and communications center (Table 5.1). It is also the principal center for producing, distributing and using decision information for the private and public sectors of the region. Thus, the activities concentrating in the metropolitan core area are information intensive. They can afford to pay the high site costs of the metropolitan downtown district because of its market access advantages over other locations. They experience relatively little risk because of location and capacity for achieving high levels of productivity and flexibility in resource use.

Table 5.1 Criteria for Assessing a Region's Vulnerability to Changing Market Conditions and Government Policies

Criterion	Core Area	Transitional Area	Periphery
Risk	Low	Moderate	High
Cost			
Site	High	Moderate	Low
Transfer	High for commodities; low for information	Moderate	Low for commodities; high for information
Productivity	High	High in branch plants; moderate in small businesses generally	High in branch plants; low in small businesses generally
Flexibility	High	Moderate	Low

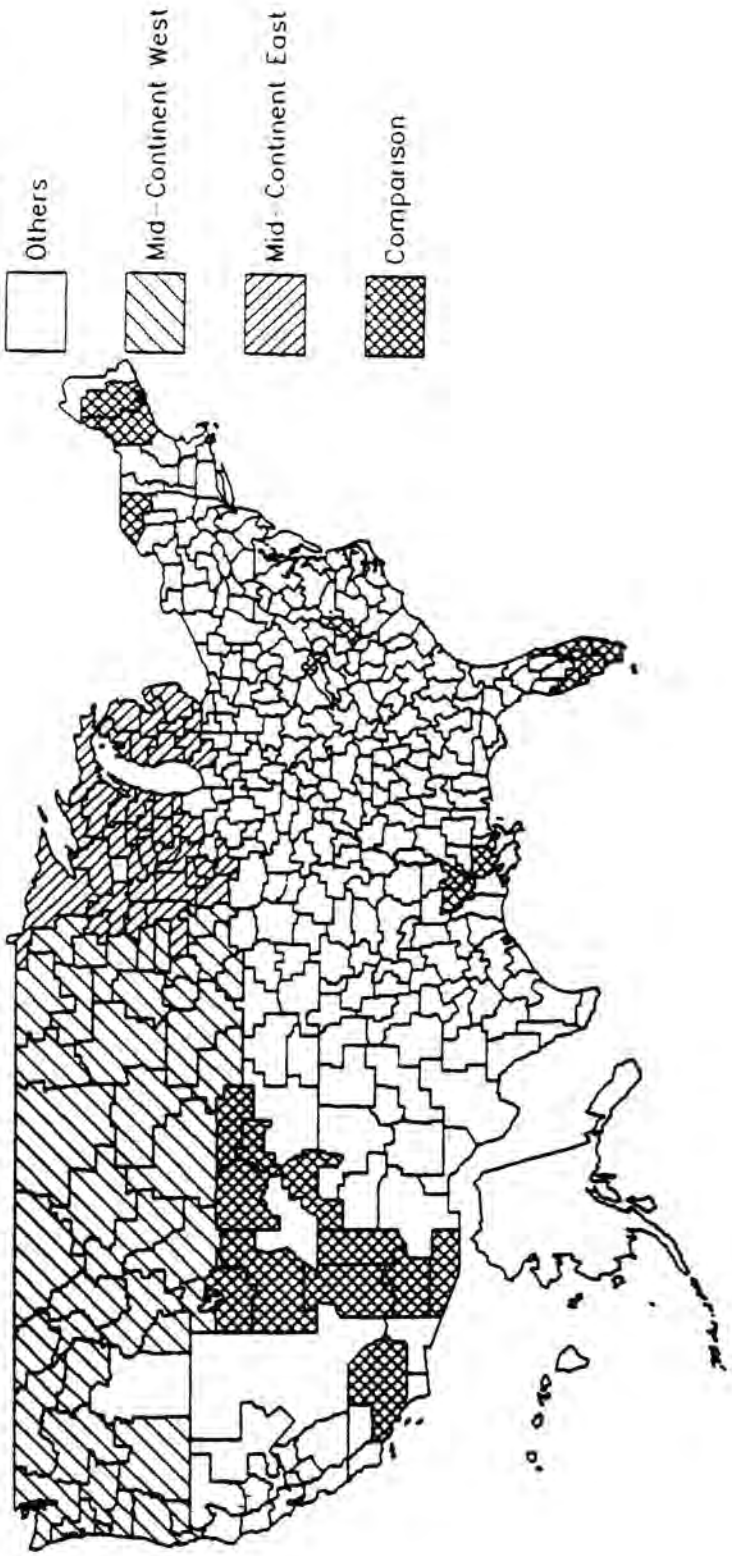
Site costs include labor costs as well as land and building costs, rent, taxes, pollution abatement costs, and other regulatory costs. Transfer costs include transportation charges and other marketing and transaction costs. Transfer costs differ most between standardized commodities, like No. 2 corn, that competes worldwide on a unit cost basis and highly differentiated products, like market or medical information, that compete on a quality as well as a cost basis. Transfer costs for certain information, for example, are lower in the metropolitan core area than in rural areas because of the necessity of one-on-one relationships in producing, distribution and using this information. These costs may be prohibitively high in rural areas and, therefore, unavailable.

The four criteria for transitional rural areas are in their mid-range between the core area and peripheral area values. Productivity of resource use, however, is high because of access to capital financing and high value of investment per worker. Peripheral areas are furthest from the spillover effects of metropolitan development. Agriculture, forestry or mining in many peripheral areas overshadows manufacturing as the dominant economic base. Businesses face high risks because of specialization in cyclically sensitive or government policy sensitive industries. Productivity per work is generally low, except in businesses with high investment per worker and superior market access

The *residentiary* sector of local industries supports the export-producing sector and serves the resident population of the local labor market area. This sector is increasingly important to the success of the local export-producing sector, firstly, by providing essential production inputs and, secondly, by providing attractive consumption choices for the resident population.

FIGURE 5.1

LMA's Selected for Shift–Share Analysis



Source: Paul D. Reynolds and Wilbur R. Maki, **Regional Characteristics Affecting Business Growth: Assessing Strategies for Promoting Regional Economic Well-Being**, Dept. of Sociology and Dept. of Agricultural and Applied Economics, University of Minnesota. November 1991.

FIGURE 5.2

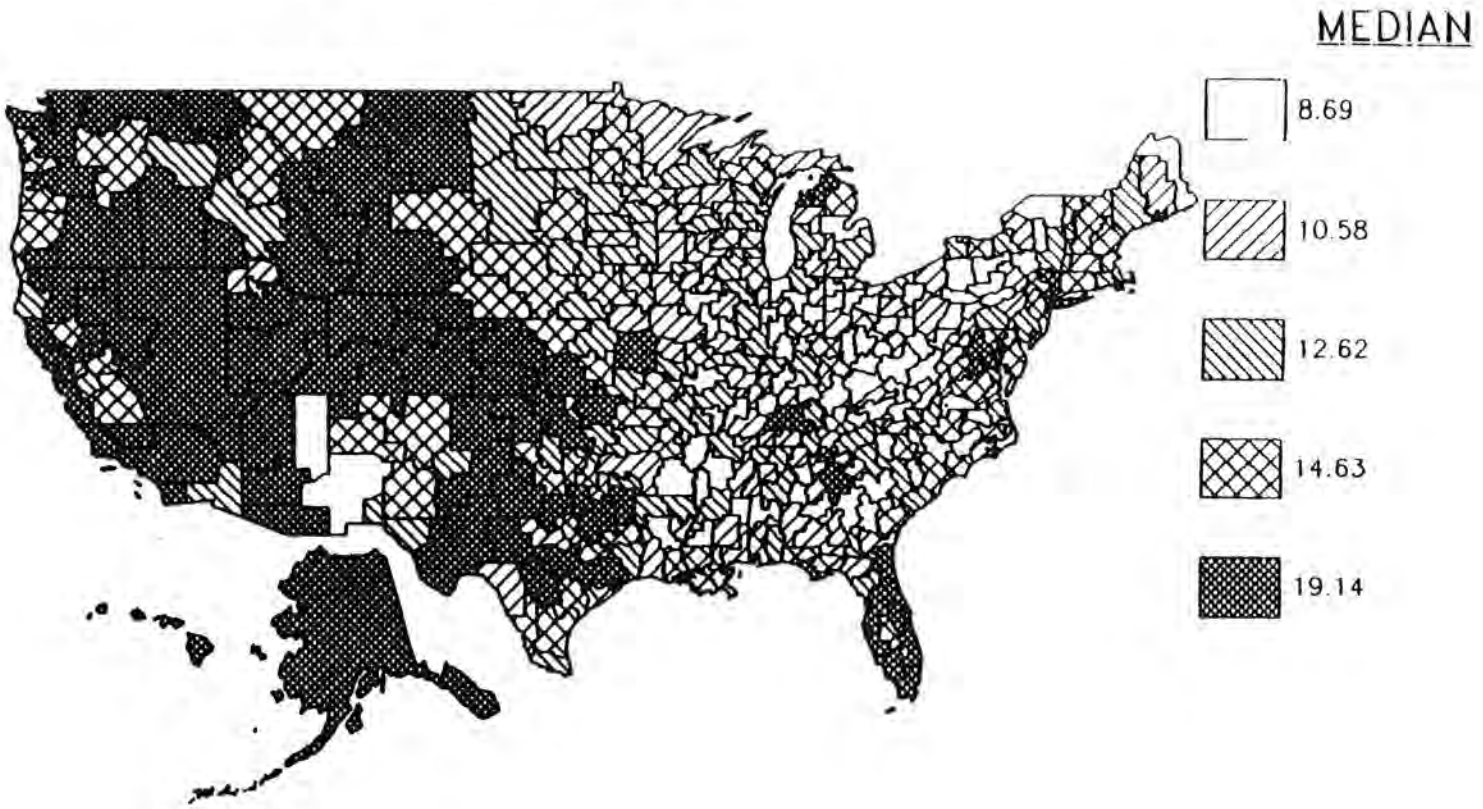
PERCENT JOB CHANGE: 1978–88

Source: Paul D. Reynolds and Wilbur R. Maki, Regional Characteristics Affecting Business Growth: Assessing Strategies for Promoting Regional Economic Well-Being, Dept. of Sociology and Dept. of Agricultural and Applied Economics, University of Minnesota, November 1991.

FIGURE 5.3

AVERAGE AUTONOMOUS NEW FIRM BIRTHS: 1978–8E

PER 10,000 POPULATION



Source: Paul D. Reynolds and Wilbur R. Maki, Regional Characteristics Affecting Business Growth: Assessing Strategies for Promoting Regional Economic Well-Being, Dept. of Sociology and Dept. of Agricultural and Applied Economics, University of Minnesota. November 1991.

IMPLICATIONS FOR STATE TRANSPORTATION POLICY

One interpretation of the study findings is that a particular region's location in the national and global regional settlement and trading systems imposes severe constraints on regional development options. A rural LMA located well beyond the outer commuting limits of any metropolitan LMA has diminished prospects for long-term economic viability beyond the lifetimes of its principal product cycles. These are some tentative conclusions from comparisons of the contrasting labor earnings and employment experience of selected core versus selected peripheral labor market areas in the U.S..

Contrasting Core and Peripheral Areas

A series of statements contrasting the two types of areas--core and periphery--summarizes the principal findings of the two studies cited earlier. The study findings (Maki and Reynolds, 1991) show for the five two-year periods from 1978-80 to 1986-88 that:

- Slow-growing labor market areas (LMAs) are not consistently slow-growing and fast growing LMAs are not consistently fast growing. However, slow-growing areas in total are consistently slow growing and the fast-growing areas in total are consistently fast growing in each of three time periods.

- Slow-growing areas experience both a negative industry effect and a negative regional share effect during each of the three time periods. Fast-growing areas experience both negative and positive industry mix effects and generally positive regional share effects.

- Slow-growing areas are concentrated in the sparsely populated parts of the study region while fast-growing areas are concentrated in and around metropolitan core areas.

- Exceptional shifts in the commodity-producing sectors accounts for high income volatility among LMAs while low volatility areas generally maintain their diverse base economy.

- Rural areas with some exceptions retain high levels of industry specialization, while metropolitan areas generally sustain their diversified base economies.

- High business (not income) volatility is associated with high growth and low business volatility is associated with low growth.

- Access to, and choice of, airline node is associated with high growth.

- Sunbelt location is associated with high growth much of the time but low growth when the product cycles of dominant basic industries have a strongly negative industry-mix effect.

The peripheral LMAs dominate the standardized and readily tradeable products cluster. The metropolitan LMAs dominate the non-standardized less readily tradable products cluster. Successful strategies for maintaining and improving on existing business locations, products and technologies thus differ for the two types of industry clusters.

Small export-producing businesses in peripheral areas may access to markets through various contractual arrangements with core area businesses. These include outsourcing by core area producers during peak production periods and promotion of training sessions sponsored by core area producers for input-supplying businesses. New public-private partnerships address the advantages of cooperation between rural and metropolitan area businesses and institutions in strengthening local and regional infrastructure and support industries for interregional and global competition.

In summary, the peripheral LMAs are most vulnerable to cyclically induced income volatility while metropolitan core areas benefit most from business volatility. Transitional rural areas experience high income and business volatility and, also, high income growth.

Attributes of Local Economic Environments

The study findings presented earlier show a high degree of industry specialization in most LMAs, especially among those with the highest income volatility. The incidence of specialization has not changed among individual LMAs with the highest income volatility.

Overall, reduced dependence on agricultural specialization among the 100 selected LMAs balances increased dependence on manufacturing specialization. Until the 1982-84 period, mining specialization also was important. For most LMAs with a rural or manufacturing orientation, replacement of extreme dependence on industry specialization with a more diverse base economy seems unlikely, given the factual evidence presented earlier. Thus, the recent history shows that:

- Peripheral rural LMAs are overwhelmingly dependent on the utilization of local natural resources. Efficiency in the conversion of primary resources into finished products reduces the demand for primary products and places many peripheral areas at risk. Often cited, also, but less evident, is the decoupling of advanced manufacturing from primary production. In any event, advanced manufacturing clearly is skill-dependent, which favors industry location in core metropolitan areas and adjoining rural areas and in new industrial spaces in formerly peripheral areas now anchored to cities that serve as small scale metropolitan core areas.

- Transitional LMAs are exceptions to the overall pattern of continuing industry specialization. They are close enough to the metropolitan core area to gain new industry, particularly new businesses of industries branching from the metropolitan core area to low cost sites in nearby rural areas. Also, a new, diverse base economy is emerging in the transitional LMAs because of metropolitan core area businesses subcontracting with transitional area businesses. Thus, transitional rural areas experience high income growth and high income volatility and, also, high business volatility.

- Metropolitan LMAs, with the exception of areas marked by negative industry mix and regional share values in a highly specialized base economy, generally are the fastest growing in labor earnings. At the same time, income volatility may range from the lowest to among the highest LMAs. A high degree of dependency on a specialized base economy would still sustain high income growth as shown by the strongly positive industry mix and regional share effects. Business volatility is generally high in metropolitan areas.

The promoting of regional growth is a regional issue, therefore, severely constrained in its successful implementation. The realities of business location, industry product cycles and access to new product and process technologies are constraining influences on regional growth.

An important attribute of an optimal location for a business enterprise is the local infrastructure--the physical facilities and economic resources shared, in varying degree, by all local businesses (Aschauer, 1991; Porter, 1990).

For the most part, the local infrastructure is in the public sector, although it includes important quasi-private and private enterprise. The local infrastructure includes the regulated industries--transportation, communications and

public utilities--and banking, finance and insurance companies, management consulting agencies, and research and development laboratories (Moss and Brion, 1991; Noyelle and Stanbeck, 1984).

Each industry cluster in a local community shares the total local infrastructure, which represents the macro-economic entity that relates to the individual export-producing businesses in the local economy. By definition, the export-producing businesses are part of the local base economy. Typically, the largest employers in this category are branch plants or headquarters offices of multi-national companies trading in global markets (Daly, 1991). Corporate decisions based on national and global rather than local considerations particularly affect branch plants. The quality and availability of local training and education in public schools and post-secondary educational institutions also affect the productivity of the local work force.

The location attribute for strengthening a region's economic base includes support industries serving the region's residentiary sector and the local transportation and telecommunications infrastructure. Local governmental efforts and the local macro-economic environment directly affect both supporting industries and local infrastructure.

Support industries produce goods and services for local intermediate and final markets. Local industries purchasing semi-finished products are the intermediate markets while households, businesses and governments purchasing finished products are the final markets.

The location attributes of support industries are simple and straightforward in their implications for new business formation: all markets are local. Import from outside the LMA fulfills the excess product demand. Therefore, economies of scale in production and production knowledge are the critical limiting factors facing entrepreneurial efforts in establishing strongly competitive new business ventures tapping into existing local markets.

Business volatility, as measured by changes in business births, deaths, expansions, and contractions, is an essential condition of a dynamic regional economy. The unique industry mix in the region and the competitive position of the region's export-producing, income-generating businesses in national and global markets ameliorates the importance of business volatility. Stage of the general business cycle and the region's industry composition qualifies the growth-facilitating and growth-inducing effects of business volatility for a region. Thus, our understanding of the conditions for regional growth and change is capsuled in a series of findings that bring us to the starting premise.

Economic base is basic. This paper starts with the premise that transportation is a passive agent of economic growth and change. It is a necessary but not a sufficient condition for economic base expansion.

Of primary importance to any region is its economic base--the export-producing industries that bring into the region the "first" dollar that circulates and recirculates as its provides sustenance to the region's resident-serving industries.

The core metropolitan area of the extended economic region, like the Upper Midwest, provides the infrastructure and essential environment for the new engines of regional economic growth. Its public and private facilities and services are increasingly important determinants of successful business enterprise.

Central cities that form the core areas of the extended city-region have the diversity of industry, producer services, and business entrepreneurship to innovate and improvise in the development of new products and processes that replace existing imports and expand exports. They are an integral link in the global transportation and communication network. The gross domestic product ultimately depends on the success of the central cities in expanding their trade with other cities and labor market areas of the city region.

The central city faces continuing internal challenges as it becomes the change-agent of the new global economy. Its downtown district transforms into the "nerve center" of the city region. Air transportation and telecommunications systems, along with a full range of strategic management and other producer services, must

connect the downtown businesses with domestic and international clients and customers on virtually a real time basis.

Peripheral areas--the sparsely populated labor market areas producing largely standardized, tradable agricultural, mineral and timber products--benefit from export growth. However, the economic and political importance of these products and their areas of production has declined in recent years because of reduced requirement for energy and other material inputs.

Earnings per worker are high in metropolitan core regions. Investment per worker is also high in the metropolitan core areas. Yet, the two contrasting types of regions are interdependent local economies. Business volatility is positively, rather than negatively, associated with economic growth.

Business volatility correlates with employment change Changes in the number of firms and related jobs due to establishment births and deaths and job expansions and contractions define business volatility. Four variables--autonomous births and deaths and branch births and deaths--represent firm volatility. Eight variables--the factorial combination of autonomous and branch, births and deaths, and expansions and contractions--represent job volatility.

Business volatility variables correlate positively with employment change in the studies addressed in this report, except for branch births and branch deaths in the 1982-84 period and job growth associated with branch births in the 1986-88 period. Autonomous firm births consistently have the largest effect on total area employment.

Business volatility affects labor market areas with a rural emphasis more strongly than LMAs with an urban metropolitan emphasis, particularly about autonomous births and autonomous expansions. While LMAs with a rural emphasis may experience more income volatility than LMAs with an urban metropolitan orientation, they also are more susceptible to the positive influences of increased business activity. One result of a concurrence in firm births and job expansions as well as firm deaths and job contractions is an economic dynamism that shifts local resources into more productive enterprises.

Market access as represented by proximity to one or two of the 29 US airline nodes is a statistically significant location attribute for differentiating among LMAs. It helps articulate the role and dimensions of location in regional economic growth and change.

Each of the three economic orientations cited earlier has a different response to the market access variables. Proximity to primary and secondary airline nodes correlates positively with employment change, especially for the LMAs with a rural orientation. Proximity to two airline nodes is most important to LMAs with a metropolitan orientation.

Location affects long-term economic viability. One interpretation of the study findings addressed in this report is that a particular region's location in the national and global regional settlement and trading systems imposes severe constraints on regional development options. A rural LMA located well beyond the outer limits of any metropolitan LMA has diminished prospects for long-term economic viability because of reduced access to vital business and market information. Such an area lacks the economic and political power to seriously affect the decision options of the largest export-producing businesses.

At best peripheral areas face a gradual decline in economic and social well-being. If fortunate, some new sense of fairness in the implementation of contractionary public policies affecting natural resource-based local economies would allow those left behind to live their remaining years with dignity and grace. More likely than not, however, the decoupling of primary production from advanced manufacturing systems will lead to radical change in the spatial-economic organization of regional activity systems. Peripheral areas of metropolitan-focused regions thus sooner, rather than later, become the parks, playgrounds and ecological preserves for an environmentally conscious, dominantly urban population. The Northern Plains, for example, are the future "buffalo commons" according to some regional analysts.

An alternative interpretation of the study findings is that peripheral areas of metropolitan-focused regions are, in large numbers, transitory. Those close to metropolitan core areas experience the overspill effects of rapid population growth in the core area. A new location equilibrium for manufacturing enterprise, driven by lower site and production costs, transforms many rural communities into the expanding urban frontier of the metropolitan core area (Scott, 1988).

The new industrial spaces emerge initially in rural areas adjoining the metropolitan core area. They expand gradually into the more distant areas within 100 miles or so of the core area borders.

For distances beyond 100 miles in the rural periphery, cities of 100 thousand or more attract new industries seeking low cost sites and access to the "knowledge workers" and information sources at local post-secondary education institutions and libraries. Such a city is Fargo, North Dakota, together with the adjoining city of Moorhead, Minnesota. Trondheim, the home of the Technological University of Trondheim, Norway, is another city that provides periphery-to-core area linkages for sustaining viable communities in formerly peripheral areas.

The metropolitan core area of a radically transforming economic region remains an integral link in the global transportation and communication network (Irwin and Kasarda, 1991). However, it, too, faces internal change. Its downtown district is rapidly becoming the "nerve center" of the extended economic region with a concentration of strategic management services (Daly, 1991; Daniels, 1991; Moss and Brion, 1991). Air transportation and telecommunications systems connect the downtown with clients and customers on virtually a real time basis, globally as well as locally and regionally.

Yet, one-on-one relationships among information providers and users are even more important in the downtown district than ever before because of the uniqueness of information--its principal product--and its inherently differentiated content (Hutton and Ley, 1987; Ley and Hutton, 1987). The downtown district thus transforms into a locally-connected global information center by its strategic management functions and supporting infrastructure and services (Daly, 1991; Daniels, 1991; Leo and Philippe, 1991; Noyelle and Peace, 1991).

Institutional Factors Affecting Transportation

Institutional factors account for much of the current difficulties in optimizing public and private investment in transportation infrastructure. The institutional factors include (1) state and local subsidy of exurban infrastructure and federal tax expenditures (i.e., deduction of interest payments on home mortgages) for residential housing, (2) exclusionary use of subdivision and zoning regulations, (3) public subsidy of long-haul trucking, (4) restrictive rules and practices of railroads, and (5) long-standing politicizing of federal public works programs and spending. These intrusions into land use decision processes at the local level result in inequitable and inefficient land uses that add measurably to transportation costs and, in turn, to the private and public costs of urban infrastructure and related services. The "crisis of the cities" is, in large part, the result of these policies.

Public subsidy of exurban infrastructure and private housing. Public subsidy of access roads and highways to the expanding urban periphery of metropolitan areas invited "leap frog" residential development that resulted in costly urban sprawl. Growing separation of place of residence from place of work also added to costs of local transportation that, in large part, became a public cost.

James Hoben, program manager for land use research, HUD Office of Policy Development and Research, reports on the cost of sprawl study, which he jointly directed with Edwin Clark of the Council of Environmental Quality and Cheryl Wasserman of the Environmental Protection Agency. This study found that:

- Total capital investment costs for the higher density community are 44 percent less than those for the lower density community;

- Energy consumption is 44 percent less for the higher density clustered community, air pollution is 45 percent less, with pollution from automobiles 20 to 30 percent less;

- Personal time costs were less in the higher density development with less time involved for traveling to schools, jobs and shops.

Thus economic and environmental considerations, as well as opportunity costs, strongly support the containment of urban sprawl.

Exclusionary use of zoning and subdivision controls. States have virtually complete power to establish any land use controls they want, subject, of course, to due process. These powers include zoning regulations, subdivision controls, municipal growth management and land development fees. Legal opinion protects the exclusionary uses of large lot sizes and open space preserves.

Large lot size and open space requirements favor the construction of high-income housing in the open country. Central cities and the first ring of suburbs are left with the low-income housing, but without the tax base to support the high cost of providing social and economic services for those left behind. Those who have the money to buy large lots and build expensive housing can move away from the problems of the central city and first ring suburbs and at the same time reduce their municipal taxes and mortgage interest payments by one-half or more.

Two serious consequences (apart from its outright unfairness) flow from the exclusionary land use controls, namely, the inability of local governments to work for the common good and the proliferation of subsidized shopping centers that simply redistribute the total spending of the metropolitan region, but add to its total transportation costs--public and private. No municipality can bribe another, for example, to locate its land fill in the other municipality. Nor will any suburban municipality readily allow the location of a job-creating facility within its boundaries that serves the entire metropolitan area. Thus, total jobs available to the central city and first-ring suburban residents are reduced by the exclusionary practices.

Maintenance and re-enforcement of the separation of place of work and place of residence imposes large private and social costs in maintaining the urban metropolitan infrastructure. Much of the available financial resources of state and local governments are absorbed by the transportation infrastructure for serving new shopping centers. Not only is the total transportation bill higher, but the environmental costs also increase because of the readily available public financing of local transportation infrastructure.

Public subsidy of long-haul trucking and personal transportation. Long established documentation of the high public costs of highway construction and maintenance resulting from long-haul trucking has had only minimal influence on the taxes paid by long-haul truckers. This is not the fault of the trucking industry but of the legislative bodies and the voting constituencies that support them. Disassociation of the benefits and costs of long-haul trucking also adds to total transportation bill.

Closer scrutiny of all public infrastructure spending, together with increasing public pressures to reduce government spending in the future, puts a premium on *productivity improvements* in the construction and use of transportation infrastructure. These improvements in the productivity of transportation resource use would reduce the total transportation bill. They include measures for (1) reducing travel from place of residence to place of work, (2) reducing material inputs, (3) increasing the efficiency of personal transportation, (4) increasing the efficiency of business transportation, and (5) improving the cost-effectiveness of public expenditures for transportation infrastructure.

Personal expenditures for transportation and public expenditures for highways account for two-thirds of the total transportation bill. Thus reducing the distances to work and shopping and improving the productivity of personal transportation account for a large share of potential cost savings.

Energy conservation measures affect the demand for transportation by reducing the tonnages transported by truck, rail and barge. A gasoline tax of 50 cents per gallon also adds $50 billion to the federal treasury and results in reduced energy use, given a price elastic transportation demand.

Alternative means of *travel to work and shopping* are feasible even with existing urban land use control. They become even more feasible with the revamping of these controls.

Freight consolidation and multi-modal transportation use by businesses engaged in commodity shipments, including increased use of rail, also reduce total transportation costs.

Included in the targeting of transportation spending is the adoption of "zero maintenance" strategies. Such strategies gradually bring public transportation spending, particularly in declining areas, in line with present and projected use of the transportation infrastructure.

A gradually increasing gasoline tax adds to private costs, but it reduces pollution abatement costs by billions of dollars.

The net savings are not necessarily converted to a reduced transportation bill. They may become available, instead, for new transportation facilities and services and an improved business environment and quality of life for local residents.

FINDINGS AND CONCLUSIONS

This final step in assessing various transportation policy implications of recent trends in traffic-generating activity focuses on the Minnesota economy as an interdependent and interacting system of local labor markets and their transportation nodes and centers. We bring together the two most recent data series--the one for the Twin Cities Metropolitan Council Region, the other for Greater Minnesota--into a consolidated set of findings on transportation and the economy of the State of Minnesota.

This report started with the premise that transportation is a passive agent of economic growth and change. It is a necessary but not a sufficient condition for economic base expansion.

Economic base theory provided the underlying rationale for the analytical framework of this study. the export-producing industries are the economic base that bring into the region the "first" dollar that circulates and recirculates as its provides sustenance to the region's resident-serving industries and population.

Because forecasts and projections of export-producing industries and their markets are increasingly important information inputs in state and local transportation systems policy and planning, we presented a factual basis for their preparation and interpretation. we referred to their underlying determinants as introduced into the projections prepared by the U.S. Department of Labor and the U.S. Department of Commerce. These projections provide the transportation policy makers and planners essential information for better understanding the unfolding future and its implications for state and regional transportation systems development and financing. Globalization of all regional economies means, however, that most forecasts and projections are quickly outdated by unanticipated events. At least a partial resolution of this problem comes with the use of scenarios of alternative economic futures for a state or region. To demonstrate the applicability of future scenarios construction and use, a series of three U.S. and international economic futures were presented in this report. These are translated into corresponding forecasts of state and substate regional economic conditions facing transportation systems planners in Minnesota and the Upper Midwest states in the companion report that follows this one.

An initial focus of this report was the presentation of an economic framework for relating the transportation requirements of individual state and regional economies to the tasks of state and regional transportation systems policy and planning. This report illustrates the use of such framework in assessing the economic trends in traffic generating activity in the U.S., with a presentation of the base year values for two Minnesota regions. These values now form a consolidated data base on transportation and the economy in the State of Minnesota.

Transportation is a key measure of the state's economic base.

Table 7.1 provides an overview of the state's transportation-industrial structure--the critical linkages among different industry groups and sectors in the state's economy and with the transportation sector. Domestic, that is, local, within-state industry, household and government purchases of transportation total to $3.9 billion. Foreign exports add another $105 million to this total. Commercial transportation is thus less than four percent of total product disbursements to intermediate and final markets in Minnesota that in 1990 totaled to $131 billion (in 1982 dollars). Added to this product total are foreign exports of more than $10 billion. Federal, state and local government outlays for transportation are not included nor are the household expenditures for personal transportation. Also spending on transportation related manufactured products would add enormously to these totals--$3.2 billion for transportation equipment and $3.9 billion for petroleum products. The transportation industry cluster in Minnesota thus accounts for total spending, once adjustments are made for non-transportation uses of petroleum products and for public and personal transportation outlays, but exclusive of the uncounted social costs, that is equivalent to nearly 20 percent of the gross state product. This makes the transportation industry cluster a dominant sector of the state's economy that critically affects its viability and capacity to meet the new challenges of the global marketplace.

Table 7.1 Total purchases of specified industry output, by domestic producing and consuming sectors, and foreign trade sector, Minnesota, 1990. (1982 $)

Industry	Total Domestic Purchase	Manu-fact'g	Other Goods Prod'g	Trans., Comm., Pub Util	Other Services Prod'g	Personal Consump Expend	Private Invest ment	Federal State& Local	Foreign Exports	Foreign Imports	Net Exports
	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)
Total product disbursements	130,885	25,853	10,175	3,706	16,787	47,968	15,120	11,277	10,294	8,642	1,652
Agriculture, for., fisheries	5,582	3,264	1,689	2	354	185	46	43	841	80	761
Mining	701	200	258	204	15	4	13	6	110	2,311	-2,201
Construction	9,528	190	126	389	1,160	0	6,246	1,416	3	33	-31
Manufacturing	45,549	15,417	4,130	940	3,399	11,455	8,016	2,191	6,489	5,642	847
Durables	24,629	8,405	2,335	227	1,279	3,434	7,617	1,332	4,861	3,699	1,162
Transport equip (exc motor)	534	175	2	68	8	97	173	11	112	207	-95
Motor vehicle & equip	2,589	319	23	12	321	1,770	52	90	148	1,212	-1,064
Non durable	20,920	7,012	1,795	714	2,121	8,021	399	859	1,628	1,943	-315
Petroleum and coal prod	3,916	355	702	634	342	1,635	39	210	84	73	12
Tran., comm., public utilities	11,403	2,338	1,184	1,236	2,072	3,792	99	682	764	207	557
Transportation	3,888	808	552	646	326	1,299	52	194	714	105	609
Communication	2,345	362	105	450	700	785	47	196	44	86	-41
Electric, gas, & sanitary serv	5,169	1,168	527	439	1,046	1,698	0	292	5	17	-11
Trade	13,600	1,556	852	91	472	9,900	555	176	999	14	986
Fin., ins., real estate	16,138	417	597	234	4,377	10,315	101	97	413	2	410
Private services	21,340	2,171	1,296	566	4,452	12,009	44	803	224	0	224
Government	7,047	300	44	44	486	308	0	5,865	451	352	99

This tabular summary shows that households and manufacturing businesses are the leading markets for the transportation industry cluster in Minnesota. They account for more than three-fourth of the transportation equipment purchases, nearly 60 percent of petroleum product purchases, and more than one-half of the spending on commercial transportation. By far the larger of two is the personal spending of households for transportation-related services and equipment.

Table 7.2 provides a detailed breakdown of the spending on commercial transportation by the producing sector of the Minnesota economy. Manufacturing and the regulated industries group account for nearly $1.5 billion, or 62 percent, of the $2.3 billion of total spending on commercial transportation by the producing sector. One or the other of the two industry groups leads every mode of transportation spending.

Table 7.2 Total sales of specified industry to intermediate demand sector in "moderate" scenario, Minnesota, 1990 (1982 $)

Industry	Agricul Forest & Fish.	Mining	Con-struct	Manu-fact'g	Durable Goods	NonDur Goods	Trans., Comm., PubUtil	Retail& Wh'sale Trade	Fin., Insur., RealEst	Private Service	Gov't Enterpr
	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)
Transportation, only	229.4	26.0	296.4	808.2	277.3	531.0	646.3	79.5	54.6	150.0	42.3
Railroad transportation	16.6	2.0	14.6	131.9	30.5	101.5	57.8	1.2	0.3	6.2	4.8
Local & interurb pass. tran	0.2	0.1	1.1	4.0	1.9	2.1	3.7	3.3	3.4	3.9	0.4
Trucking and warehousing	180.2	18.2	251.0	562.6	199.6	362.9	336.2	59.7	28.9	64.6	17.6
Water transportation	1.0	0.2	1.3	8.6	1.6	7.1	3.8	0.2	0.0	0.9	0.4
Transportation by air	2.7	1.6	5.4	60.9	33.4	27.5	22.2	6.1	10.5	40.3	5.2
Pipelines, exc natural gas	28.8	4.0	23.1	39.6	9.9	29.7	61.7	7.6	2.5	28.1	13.9
Transportation services	0.0	0.0	0.0	0.5	0.3	0.3	161.0	1.3	8.9	6.0	0.2
Communication	29.0	7.2	69.0	361.7	216.5	145.2	150.1	125.4	135.2	430.5	8.9
Electric, gas, & san. serv	200.2	264.0	62.4	1,168.1	462.9	705.3	439.1	216.8	23.8	442.4	362.9
Tran., comm., utilities	458.5	297.2	427.9	2,338.0	956.6	1,381.4	1,235.6	421.6	213.6	1,023.0	414.0

Because of its facilitating functions in sustaining and expanding the access of the state's exports-producing industries to domestic and foreign markets, the transportation industry cluster continues to perform an important role in the state's economic future. It relates directly to the total value of these exports and in so doing provides a key measure of state's economic base.

Wide differences exist among the alternative futures for transportation planning.

This report starts with a presentation of the most widely accepted U.S. statistical series representing alternative global and national futures that critically influence local and regional economies. It provides conceptual and analytical frameworks and data that will be available ultimately for the use of current transportation origin and destination models in demonstrating implications of state and regional shifts in population and economic activity for transportation systems planning. It thus helps build an ongoing capability for monitoring changes in state and

regional economies and introducing these changes into the shaping and evaluating of transportation development priorities.

Alternative scenarios of U.S. economic growth and change over the 20-year period from 1990 to 2010 are presented as overall frameworks for assessing the role of public infrastructure spending in the state and regional economies of Minnesota, the Upper Midwest, and the individual states in the Northern Transportation Corridor Region. Preparation and presentation of these scenarios addresses an important objective of the overall study, namely, to provide an appropriate and timely economic context for state and regional transportation policy and planning..

The driving force for the economic trends in the three BLS scenarios is the productivity of the U.S. work force. Low growth correlates with low labor force productivity while high growth correlates with high labor force productivity. Thus, in spite of the larger population, a larger percentage of the total population is employed in the high growth scenario. It also has the smallest number unemployed. Labor force productivity accounts for this difference.

Productivity of resource use depends on the levels of private and public investment. These, in turn, depend upon the demand for products produced in U.S. industries, production costs, and the opportunities for profitable production by cost-reducing or market-expanding investment in new equipment, facilities and resource use practices.

Interest rates play an important part in the level, type and timing of these investments. Interest rates, in turn, are affected by the U.S. fiscal deficit and the "crowding out" effects of financing this deficit from a limited U.S. and global savings pool.

The growth in GNP per employee associated with an increase in private investment makes possible export expansion and its rise as a proportion of total final sales. Improved productivity of U.S. export-producing industries and reduced demand for available savings to finance a federal fiscal deficit sustains export expansion in competitive global markets.

Export expansion rests on a shift in current federal priorities from the present to the future. These, in turn, involve corresponding reductions in the proportion of final sales for personal consumption and government, particularly military spending. Several military spending scenarios are reviewed, therefore, because of their critical importance in the preparation of state and regional planning scenarios.

Government is an important player, affecting all transportation decisions. It gains high marks in affecting the direction and location of economic change. Federal, state and local outlays for transportation system improvements invariably involve changes in the economic base of local economies and commuting patterns.

Each future alternative has its unique trade-off for the Minnesota economy.

Global competition offers few choices. Each future alternative has its unique and special trade-off for the individual states in the Upper Midwest Region. The most likely scenario is one of moderation, neither above nor below the U.S. rates of economic growth. Of course, Minnesota 2005 and 2010 will differ much from Minnesota 1990. Metro Minnesota does slightly better than the U.S. This is the "control" forecast.

The Minnesota "moderate" scenario tracks the U.S. Department of Labor "moderate" projection series in industry employment, labor earnings and personal income to 2005. The U.S. Department of Commerce extends the projections to 2010 (and later years) for individual states.

The U.S. "moderate" projection series assume some changes in U.S. fiscal and trade conditions. They assume gradual reductions in the federal fiscal deficit, the foreign trade deficit, personal consumption expenditures, military spending, and foreign exports. These reductions balance, in part, the increases in federal and state taxes,

business investment, state and local government spending and foreign imports. They also assume a slowing down of the growth in labor force, industry employment, labor productivity and gross domestic product.

The Minnesota economy has a jobs base of more than two and three-fourths million. However, it still suffers from the decline of its largest sectors--farming, mining, construction, computer and office machinery manufacturing, retail trade, banking and credit agencies, and hotels and other lodging places.

Federal budget reductions provide savings for possible re-allocation to transportation.

Combined federal, state and local government expenditures continue to exceed combined total receipts because of the continuing deficits of the federal government. The net difference between receipts and expenditures increased from a $101.5 billion deficit in 1975 to a $195.1 billion deficit in 1990. This difference was projected at only -$4.9 billion in 2000. In the more recently prepared projections to 2005, difference widened to -$157.4 billion.

The short-term opportunity cost of budget reducing measures in the federal government is high. If the entire "peace dividend" were used to reduce the federal budget deficit, its contractionary consequences would reduce GNP growth in the first five years. In the next five years, however, the earlier budget re-allocations would begin to reap benefits in higher earnings for both labor and capital that would gradually reduce the GNP gap from what it would have been without the deficit reductions.

Increases in final product sales in the deficit reducing budget are directed towards private investment rather than personal consumption in the early 1990s. Analytical results show positive linkages between increases in private investment and export expansion. An increase of $106.5 billion in private investment is associated with a differential increase of $113.6 billion in exports and a differential decline of $84.9 billion in imports during the 1990-2000 period. In the next 10-year period, a differential increase in private investment of more than $1.4 trillion is associated with a differential increase of nearly $900 billion in exports and nearly $500 billion in personal consumption expenditures. Thus, the aggregate changes over the two 10-year period include the short-term income-reducing effects of reduced military spending and the first years of the long-term productivity-increasing effects of the shift from consumption to investment accompanying the reduction in military spending.

Transportation policy makers and planners understandably question the relevance of the projected budget figures for transportation investment planning. Loss of the potential savings from reductions in military spending is real, however, in the sense that the loss underlines the high cost of earlier spending excesses.

Large increases are projected in overall state and local spending, but these may compete with transportation.

State and local infrastructure expenditures generally include other public facilities besides transportation. Public education also is viewed as an integral part of public infrastructure. In 1990, state and local government education expenditures--elementary and secondary, post secondary, and other education-related infrastructure--were more than 70 percent of total infrastructure expenditures, These included highway, water and air transportation, transit and other transportation infrastructure as well as electric power and gas utilities, water supply systems, other urban facilities and natural resource-related infrastructure in the public sector.

Direct spending of $341.8 billion on state and local infrastructure over the eight year period from 1992 to 2000 amounts to 5.5 percent of total state and local government expenditures or 3.5 percent of total federal government expenditures in the 1990s. It is also equivalent to 34 percent of total grants in aid from federal to state and local governments projected in the "moderate" BLS scenario.

The direct spending on state and local infrastructure represents various forms of capital investment. State and local governments lack capital budgets and measures of capital investment for the purpose of comparing public returns and trade-off among the various categories of current and capital spending. Knowing the magnitude and distribution of these expenditures, by time and place, is an important step in moving towards the construction and use of state and local capital budgets.

Economic base is basic and so is transportation's measure of it.

Of primary importance to any region is its economic base--the export-producing industries that bring into the region the "first" dollar that circulates and recirculates as its provides sustenance to the region's resident-serving industries. Yet, much public planning and expenditures takes place as if every dollar of income generated by local economic activity is the same. A dollar created by a local drugstore catering only to local residents is viewed the same as a dollar generated by a business catering only to customers outside the region. Even worse, differences among localities and their role in regional income generation are ignored.

The core metropolitan area, like Minneapolis-Saint Paul, of the extended economic region, like the Upper Midwest, provides the infrastructure and essential environment for the new engines of regional economic growth. Its public and private facilities and services are increasingly important determinants of successful business enterprise.

Central cities of the extended city-region have the diversity of industry, producer services, and business entrepreneurship to innovate and improvise in the development of new products and processes that replace existing imports and expand exports. They are an integral link in the global transportation and communication network. The gross domestic product ultimately depends on the success of the central cities in expanding their trade with other cities and labor market areas of the city region.

The central city faces continuing internal challenges as it becomes the change-agent of the new global economy. Its downtown district transforms into the "nerve center" of the city region. Air transportation and telecommunications systems, along with a full range of strategic management and other producer services, must connect the downtown businesses with domestic and international clients and customers on virtually a real time basis.

For residents of both the central city and the city region, however, the drag of low productivity and the heavy burden of government regulation is too much. Many businesses face bankruptcy and closure leaving behind a former workforce without replacement jobs. Widespread economic dislocation becomes commonplace from the central city to its region's periphery.

The sparsely populated labor market areas producing largely standardized, tradable agricultural, mineral and timber products--benefit from export growth. However, the economic and political importance of these products and their areas of production has declined in recent years because of reduced requirement for energy and other material inputs.

Earnings per worker are high in metropolitan core regions. Investment per worker is also high in the metropolitan core areas. Yet, the two contrasting types of regions are interdependent local economies.

The contrasting transportation markets represented by the two Minnesota regions--the Metropolitan Minnesota and Greater Minnesota--highlight their differences and, also, complementarities in providing the essential public and private facilities for successful business enterprise.

Market access and location make a difference in regional growth and development.

Market access as represented by proximity to one or two of the 29 US airline nodes is a statistically significant location attribute for differentiating among labor market areas (LMAs). It helps articulate the role and dimensions of location in regional economic growth and change.

Each of the three economic orientations cited earlier has a different response to the market access variables. Proximity to primary and secondary airline nodes correlates positively with employment change, especially for the LMAs with a rural orientation. Proximity to two airline nodes is most important to LMAs with a metropolitan orientation.

One interpretation of the study findings addressed in this report is that a particular region's location in the national and global regional settlement and trading systems imposes severe constraints on regional development options. A rural LMA located well beyond the outer limits of any metropolitan LMA has diminished prospects for long-term economic viability because of reduced access to vital business and market information. Such an area lacks the economic and political power to seriously affect the decision options of the largest export-producing businesses.

At best peripheral areas face a gradual decline in economic and social well-being. The decoupling of primary production from advanced manufacturing systems will lead to radical change in the spatial-economic organization of regional activity systems. Peripheral areas of metropolitan-focused regions thus sooner, rather than later, become the parks, playgrounds and ecological preserves for an environmentally conscious, dominantly urban population.

Rural area service centers link with metropolitan core areas to form new regional industrial systems.

An alternative interpretation of the study findings is that peripheral areas of metropolitan-focused regions are, in large numbers, transitory. Those close to metropolitan core areas experience the overspill effects of rapid population growth in the core area. A new location equilibrium for manufacturing enterprise, driven by lower site and production costs, transforms many rural communities into the expanding urban frontier of the metropolitan core area.

The new industrial spaces emerge initially in rural areas adjoining the metropolitan core area. They expand gradually into the more distant areas within 100 miles or so of the core area borders.

For distances beyond 100 miles in the rural periphery, cities of 100 thousand or more attract new industries seeking low cost sites and access to the "knowledge workers" and information sources at local post-secondary education institutions and libraries. Such a city is Fargo, North Dakota, together with the adjoining city of Moorhead, Minnesota..

Even declining rural LMAs include individual counties experiencing job growth. These counties are growing area service center that provides the high order services for the entire labor market area. The area centers typically have one or more post-secondary education institutions and a municipal or county public library system. They also have numerous public and private linkages with government agencies and businesses in the metropolitan core area. They have the principal freight-and-passenger-generating activities in the transitional and peripheral LMAs of the extended city region.

Structural change critically affects transportation systems planning and policy.

Transportation requirements of U.S. economic growth are illustrated for the 20-year period starting in 1990. Purchases of transportation services in 1990 are estimated for (1) the intermediate demand, i.e., producing, sectors and (2) the final demand sectors. Individual sector purchases in 1990 are compared with their corresponding purchases in the projected growth period from 1990 to 2010. The findings show sharply differing patterns of industry growth and accompanying transportation input requirements. Shifts in the distribution of final product from personal consumption to private and public investment and exports also result in changing requirements for particular transportation services.

Past changes in the economic of local labor market areas documented in this study point to the importance of institutional factors affecting the demand for transportation. Projected changes in the Upper Midwest and the Northern Transportation Corridor continue with the historical trends among most labor market areas. Peripheral

areas continue their decline while metropolitan core areas face similar prospects in the their central cities and first ring suburbs. For the most part, growth in population and related personal transportation is concentrated in the transitional areas within 100 miles of the metropolitan core areas.

Much of existing transportation system was built, therefore, to serve an economy that no longer exists, as clearly demonstrated by the economic trends and projections for the individual states of the Upper Midwest.. Yet additions to this system are still largely based on current population distributions and concentrations while the economic landscape is changing rapidly, especially in the transitional areas. Grossly underused and overused transportation facilities, with consequent waste of money and time of both providers and users, are the logical outcomes of ignoring the many indicators of imminent changes in regional economic activity and its localization.

For the most part, the largest current and prospective future changes in transportation infrastructure requirements are confined to areas with sharply increasing or, alternatively, gradually declining levels of population and economic activity. The fast-growing areas are located between the gradually declining peripheral rural and inner cities and long-established suburbs of metropolitan core areas.

The accumulative effects of gradual decline are less noticed than the effects of rapid population growth in planning for improved highways, new air terminals and other transportation facilities and services. If each dollar of new infrastructure spending were matched by some fraction of a dollar of reduction in infrastructure spending in the declining or less rapidly growing areas, the differential requirements for transportation facilities and services in the different areas would become noticeable. Reliable place-specific information on transportation requirements would be needed to establish such trade-off.

Thus, one problem is forecasting the city region. The end in view is building a shared vision of the future city region and its role in global competition that we still lack.

Exclusionary land use practices increase transportation expenditures

Another problem is the institutionalization of certain property rights that more infrastructure spending only makes worse. As a first approach, the performance of existing transportation and other delivery systems bears careful scrutiny. Productivity improvements offer immediate savings for use in spending on the highest-priority infrastructure replacement and expansion.

Institutional factors account for many of the current difficulties in optimizing public and private investment in city-region infrastructure, particularly transportation. The institutional factors include state and local subsidy of exurban infrastructure and federal tax expenditures (i.e., deduction of interest payments on home mortgages) for residential housing, exclusionary use of subdivision and zoning regulations, extraordinarily high transactions and related costs of "doing business" in the area, and blind acceptance, to use Jane Jacobs' words, "of the mercantilist tautology that nations are the salient entities for understanding the structure of economic life" (Jacobs, 1984; p.50). Thinking of economic development as a national, rather than a city, process ignores the importance of location and its matrix of unique attributes affecting the viability of business enterprise.

Among the most troubling institutional factors affecting city-region futures is the public subsidy of access roads and highways to the expanding urban periphery of metropolitan areas. The public subsidies invite "leap frog" residential development that results in costly urban sprawl. Separation of place of residence from place of work also added to costs of local transportation. For example, the public highway subsidy for Mall of America already approaches $200 million. Without realization of the most optimistic growth scenario for the city region, much of impact of this subsidy is simply in the form of income transfers.

Another troubling feature of urban economic life is misuse of the power given states to establish any land use controls they want, subject to "due process." These powers included zoning regulations, subdivision controls, municipal growth management and land development fees that protect the exclusionary uses of large lot sizes and open space preserves.

Large lot size and open space requirements favor the construction of high-income housing in the open country. Central cities and the first ring of suburbs secure the low-income housing, but without the tax base to support the high cost of providing social and economic services for those left behind. Those who have the money to buy large lots and build expensive housing can move away from the problems of the central city and first ring suburbs and at the same time reduce their municipal taxes and mortgage interest payments.

Two serious consequences (apart from its outright unfairness) flow from the exclusionary land use controls: the inability of local governments to support area-wide concerns and the proliferation of subsidized shopping centers that simply redistribute the total spending of the metropolitan region, but add to its total transportation costs. No municipality can bribe another, for example, to locate its land fill in the other municipality. Suburban municipalities readily turn down the location of a job-creating facility within its boundaries, especially if it serves the entire metropolitan area. Thus, the exclusionary practices reduce the total jobs available to the central city and first-ring suburban residents.

Maintenance and re-enforcement of the separation of place of work and place of residence would impose large private and social costs. The transportation infrastructure for serving new shopping centers absorbs a large amount of available financial resources of state and local governments. Not only is the total transportation bill higher, but the environmental costs also increase because of the readily available public financing of local transportation infrastructure.

Productivity improvements create savings that reduce the total regional costs.

Closer scrutiny of all public infrastructure spending, together with increasing public pressures to reduce government spending in the future, puts a premium on *productivity improvements* in the construction and use of city region infrastructure. Improvements in the productivity of transportation resource use include measures for reducing travel to place of work and the use of material inputs in local production. They also include measures for increasing the efficiency of personal and business transportation and the targeting of government spending on transportation infrastructure.

- Personal expenditures for transportation and public expenditures for highways account for two-thirds of the total transportation bill. Thus reducing the distances to work and shopping and improving the productivity of personal transportation account for a large share of potential cost savings.

- Energy conservation measures affect the demand for transportation by reducing the tonnages transported by truck, rail and barge. A gasoline tax of 50 cents per gallon also adds $50 billion to the federal treasury and results in reduced energy use, given a price elastic transportation demand.

- Alternative means of travel to work and shopping are feasible even with existing urban land use control. They become even more feasible with the revamping of these controls.

- Freight consolidation and multi-modal transportation use by businesses engaged in commodity shipments, including increased use of rail, also reduce total transportation costs.

- Included in the targeting of transportation spending is the adoption of "zero maintenance" strategies. Such strategies gradually bring public transportation spending, particularly in declining areas, in line with present and projected use of the transportation infrastructure.

- A gradually increasing gasoline tax adds to private costs, but it reduces pollution abatement costs by billions of dollars.

The net savings are not necessarily converted to a reduced transportation bill. They may become available, instead, for new transportation facilities and services and an improved business environment and quality of life for local residents.

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